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ANDERSON RANCH RESERVOIR

Abstract

We evaluated the kokanee *Oncorhynchus nerka* population in Anderson Ranch Reservoir during June 2011. Total kokanee abundance was estimated with reservoir-wide hydroacoustics and standard trawling surveys. Hydroacoustics-based abundance estimates (± 90% CI) for age-0, age-1, age-2, and age-3 were 2,924,668 (± 528,793), 167,703 (± 40,299), 78,713 (± 23,446), and 53,329 (± 20,656), respectively. Combined kokanee abundance was 3,224,413 fish (± 544,846). The combined trawl-based kokanee abundance estimate was 2,780,749 fish, representing a density of 1,671 fish/ha.

Also, during June 2011, the Smallmouth Bass *Micropterus dolomieu* population in Anderson Ranch Reservoir was monitored using standard boat electrofishing techniques. A total of 550 bass were sampled at 16 transects. Mean CPUE was 137 bass/h (± 40, 80% CI). Proportional Stock Density (PSD) was 22 with a RSD-Q of 78. Mean relative weight (*Wr*) for stock- and quality-sized bass was 86 and 87, respectively. Overall, Smallmouth Bass were slightly less than average condition, with stock and sub-stock size classes being the most commonly-sampled portion of the size distribution.

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Introduction

Anderson Ranch Reservoir (ARR) is a Bureau of Reclamation impoundment of the South Fork Boise River in Elmore County. ARR has a maximum reservoir storage capacity of 60,833 hectare meters, with 3,575 hectare meters considered dead storage (USGS 1996). ARR functions as a destination fishery for kokanee *Oncorhynchus nerka* and Smallmouth Bass *Micropterus dolomieu*. Multiple fishing tournaments for either species are held on the reservoir each year. Rainbow Trout *Oncorhynchus mykiss* and Yellow Perch *Perca flavescens* are considered by most anglers to be secondary target species, and are most often caught incidentally at ARR. Bull Trout *Salvelinus confluentus* and several other nongame fish species are also present and provide recreational angling opportunity in the reservoir.

Kokanee in ARR are managed for consumptive use with current regulations allowing a 25 fish/d bag limit and 75 fish possession limit. Recently, the kokanee populations has been monitored annually using trawls. However, in 2011 kokanee population abundance was estimated with hydroacoustics techniques for comparative purposes (Stanton et al. 2008). These surveys were conducted to provide information necessary to properly manage this fishery.

In addition to kokanee, interest in Smallmouth Bass fishing has increased at ARR in recent years. In an effort to better evaluate Smallmouth Bass population in ARR, boat electrofishing surveys were completed in June 2011; and relative population abundance, stock structure, fish condition, growth, and survival were characterized.

The objective of these sampling efforts were to monitor the kokanee and Smallmouth Bass populations in ARR to determine whether management strategies need to be altered and to collect trend information.

Methods

Kokanee Abundance Estimate

The kokanee population was monitored in ARR by conducting a lake-wide hydroacoustic survey. Hydroacoustic mobile surveying was completed during the night of August 3rd, 2011 utilizing a 17’ Boston Whaler boat. Kokanee were detected with a Simrad EK60 scientific echo sounder with a split-beam 120-kHz transducer. The echo sounder’s transducer was set at 0.5 m below the water’s surface with a ping rate and travel speed of 3.3 ping/s and 1.5 m/s, respectively. The Simrad EK60 echo sounder was calibrated using a 23-mm copper calibration sphere, with a target strength (TS) of -40.4 decibels (dB); with calibration settings being determined and input using Simrad ER60 software. Three previously-established lake sections were used in the 2011 survey in order to maintain consistency in methods with historical surveys; Lower (1) – 680 ha, Mid (2) – 590 ha, and Upper (3) – 394 ha (Figure 1).

Kokanee abundance estimates were calculated using Sonar Data Echo View software, (version 5.0.78). Within the echogram, a box was drawn around the kokanee layer of each transect (on average, 5 to 55 m deep), integrated to obtain the nautical area scattering coefficient (NASC), and analyzed to obtain the mean TS of all returned echoes (Hardy et al. 2010). This integration accounted for fish that were too close together to detect as a single target (MacLennan and Simmonds 1992). Densities were then calculated by the equation:

$$\text{Density (fish/ha)} = (\text{NASC} / 4\pi 10^{TS/10})\ 0.00292$$

Where NASC is the total backscattering (m^2/nautical mile), and TS is the mean target strength in dB for the area sampled. The target strength data from all returned echoes that qualified as single fish targets were binned into 1.0 dB intervals (adjusted target strength) for each transect. Single fish targets were categorized into kokanee or non-kokanee groups based upon their TS and the known range of kokanee total lengths from the trawl survey. All single targets less than -60.0 dB were considered too small to be kokanee fry. Targets greater than -32.0 dB were thought to be too large to be kokanee, and were most likely trout.

Previous kokanee surveys were completed at ARR using nighttime trawling techniques described by Rieman (1992). Prior to this study's hydroacoustic survey efforts, trawling tows were completed in July during the new moon phase. A 4.46-m^2 framed trawl net pulled at approximately 1.59 m/s was towed in 180-s intervals for every 3-m depth between 7.3 m and 22 m. Seven transect tows were taken per strata; which mimicked historical sampling efforts (Partridge and Warren 1995; Ryan and Megargle 2005; Ryan and Megargle 2007). Kokanee age-at-length data obtained by the trawl net survey were used in conjunction with target strength-frequency distributions to define age-class thresholds within hydroacoustic echogram data (Stark and Stockner 2006). However, trawl data collected for this study, suggested kokanee age-at-length distributions overlapped considerably (Figure 2); and therefore, this evaluation used the known-age proportions to define acoustic targets.

The age structure of the kokanee population was described using scales collected from a subsample of the trawl survey's catch. Estimated ages were pooled into 10-mm length bins, then age proportions were determined for each bin. Length bins were converted to approximate acoustic target strength bins (-1.0 dB) using Love's equation (1971). Acoustic fish targets were categorized into number of targets of each age using the aforementioned trawl-age proportions. For example, 83% of fish 285-305 mm TL (-35.9 to -35.0 dB) were age-2 kokanee and the remaining 17% were age-3 kokanee. These percentages were used to assign the number of each age per 1.0 dB bin in each acoustic transect.

Kokanee targets between -60.0 dB [approximately 16 mm TL; (Love 1971)] and-43.0 dB (123 mm), were defined as kokanee fry. Fish targets between -42.9 and - 32.0 dB were defined as age 1 – 3 kokanee (Table 1). However, trawl age proportions for given 10-mm bins assigned to subsequent 1.0 dB bins resulted in age-1 target strengths from -42.9 to –38.0 dB (124-224 mm), age-2 from -39.0 to -34.0 dB (205-363 mm), and age-3 kokanee included targets between -36.0 and -32.0 dB (305-462 mm; Figure 3).

Kokanee age class density estimates were calculated for each hydroacoustics transect. The rate of age class fish targets for each transect were multiplied by the total transect volume. Kokanee abundance estimates by reservoir section were calculated by multiplying age class densities for each acoustic transect by the volume of reservoir in that section. The total kokanee population abundance estimate was calculated by summing all reservoir sections and age class abundance estimates.

Bass Monitoring

Smallmouth Bass sampling was conducted in June 2011 when water temperatures ranged between 15 ºC and 24 ºC, and Smallmouth Bass are known to spawn (Heidinger 1975). We utilized boat electrofishing at 16 shoreline transects until 15 minutes was expended at each transect. Sample size goals for electrofishing units are based on the variance around the mean

CPUE and power analysis. Sample size was determined real-time using Data Plus Solutions Software© (Cohen 1988), and was dependent on the variance of real-time CPUE. Sampling continued until the variation around the mean CPUE achieved 80% confidence (t-value = 1.26). Sampling occurred at night using a pulsed-DC (60 Hz) waveform and a 24% duty cycle (See Appendix B for gear description). Relative abundance was measured as average catch per unit effort (CPUE) and reported as fish/h. Sample sites were randomly selected throughout the reservoir (Appendix A).

Captured Smallmouth Bass were measured for total length (TL) to the nearest millimeter, and weighed to the nearest gram. Otoliths were collected from 5 fish for each 10-mm length bins present during the sampling effort. Otoliths were prepared by centrally cracking and burning the broken edge with an alcohol burner; otoliths were coated in mineral oil and viewed at 30-40x magnification using a dissecting microscope (DeVries and Frie 1996). Mean length-at-age was calculated from each length bin. Fish growth was estimated by the mean-length-at-age summary using Fisheries Analysis and Simulation Tools, Version 2.1© (FAST).

Proportional stock density (PSD), an index of the Smallmouth Bass population's size structure was calculated using FAST© software (Anderson and Neuman 1996). Relative weight (*Wr*) was calculated in EXCEL© software and are reported as the mean Wr of the catch. Annual mortality and survival rates were estimated using a catch curve (Van Den Avyle 1993) generated in FAST© software.

<u>Results</u>

Hydroacoustic-based Kokanee Abundance Estimate

A total of 46,901 echo returns were recorded from fish within the kokanee layer of all hydroacoustic transects. Fish target strengths from returned echoes ranged between -60 and -25 dB. Approximately 92% of kokanee targets had target strengths within the fry range (Figure 3). For all transects and age classes sampled, kokanee densities ranged from 68 to 5,098 fish/ha (Table 2). Fry densities were highest in the lower reservoir, and lowest in the upper reservoir. Densities of age 1-3 kokanee were highest in the upper section of the reservoir and lowest in the lower section. Intermediate densities and size distribution were observed in the mid-reservoir section. Age-specific abundances for fry, age-0, age-1, age-2, and age-3 kokanee were estimated to be 2,924,668 (± 528,793; 90% CI), 167,703 (± 40,299), 78,713 (± 23,446), and 53,329 (± 20,656; Table 3), respectively. The abundance of all kokanee was estimated at 3,224,413 fish (± 544,846).

Trawl-based Kokanee Abundance Estimate

Total abundance of kokanee for all strata and age groups combined was estimated as 2,780,749 fish, representing a density of 1671 fish/ha. Reservoir densities of fry, age-1, age-2, and age-3 kokanee were estimated to be 1,582, 65, 17, and 7 fish/ha, respectively. Standing crop was estimated for all strata and age groups as 16.85 kg/ha (Table 4). Four age classes were represented in the trawl catch, age-0 to age-3 (Figure 4), with a mean length at age-3 of 328 mm (Figure 5).

Bass Monitoring

A total of 550 Smallmouth Bass were sampled with a mean CPUE of 137 (± 40, 80% CI). Length of Smallmouth Bass ranged from 45 to 520 mm (Figure 6). Weight ranged from 1 to 1,855 g. A subsample of 171 bass were aged. Eight age classes were identified, with a maximum age of 11 years (Figure 7). Estimated annual mortality was 37%, (Figure 9). In 2011, average length at age 5 was 237 mm. All bass older than age 5 were larger than 280 mm. PSD was 22 with a RSD-Q of 78 (Table 8), with mean relative weights of 86 for stock and 87 for quality bass.

Discussion

Kokanee Abundance

Hydroacoustic-based population estimates have not been conducted at ARR in recent years. Thus, no trend comparisons may be made. However, comparisons may be made for trawl-based estimates. Total kokanee abundance in ARR has increased dramatically (217%), from 1 million (611 kokanee/ha) in 2010 to 2.8 million (1,671 kokanee/ha) in 2011 (Table 4). Notably, most of the increase was due to increased fry and age-1 abundance (+229%; relative change).

Despite high population abundance, kokanee survival was good between August 2010 and July 2011. Annual survival of other kokanee populations with limited predation is commonly 60% (Maiolie and Elam 1995). Survival rates calculated comparing only trawl estimates resulted in an age 1-2 survival rate of 62% (August 2010 – August 2011). The five year (2006 - 2011) average survival rate (42%; excludes survival between 2009 and 2010) of age-1 to age-2 kokanee in ARR suggests that 45,400 age-1 kokanee may recruit to the 2012 age-2 year class. Age-2 kokanee are presumed to fully recruited to recreational angling.

For 2011, trawl- and hydroacoustic-based surveys produced very similar population estimates (Figure 8). Each method has known strengths and weaknesses. Midwater trawling tends to underestimate relative abundance of older, longer, and faster swimming fish as they may escape capture, but provides specimens for collection of hard parts for age analysis. Alternatively, hydroacoustics provides a quick and reliable method to estimate kokanee abundance and densities in lakes and reservoirs, but is also not without limitations (Janssen et al. 2011). During our survey, we defined all fish targets within the acoustic target strengths of -60 dB to -32 dB (16 to 462 mm) as kokanee. We also excluded fish detected outside the pelagic area, and target strengths of larger fish (≥ -32.1 dB). Despite our efforts to exclude likely non-kokanee species from our analysis, undoubtedly non-kokanee species were included in our “kokanee” abundance estimate. The extent that non-kokanee species inflated these estimates is unknown. Because of these strengths and weaknesses, we recommend continuing annual trawl surveys in conjunction with hydroacoustics to improve age class estimates for kokanee, as well as provide a comparison to hydroacoustic estimates.

The high kokanee densities noted in ARR during 2011 are likely to reduce growth rates and adult size. Estimates of kokanee abundance and density are the highest reported since 1993. Summed density (fish/ha) of kokanee for all age classes was greater than the average from 2003 to 2011(Table 5). High density younger year classes will likely yield small adults in 1-3 years.

Bass Monitoring

The abundance and condition indices observed at ARR suggests the Smallmouth Bass population is of low density and composed primarily of stock- and sub-stock-sized fish of good condition. CPUE (137 fish/h) is increasing compared to recent surveys and it is nearly double previously reported national averages (70 fish/h; Bonar et al. 2009). . PSD and mean relative weight both declined from 2008 monitoring efforts (Table 8), with mean length at age 5 also declining. Our data indicates that Smallmouth Bass require six years to reach 300 mm in ARR, while those in Brownlee Reservoir only require five years (Richter et al. 2010). Growth in ARR is slower than the average growth rate for ecoregion 10, where Smallmouth Bass reach 300 mm within 4-5 years (Bonar et al. 2009). Maximum age was 11 which is relatively long-lived. Slow growth may suggest forage limitations, or be indicative of a short growing season (Beamesderfer and North 1995).

Recommendations

1. Continue monitoring Anderson Ranch Reservoir kokanee densities as a tool for providing a consistent quality fishery. Possibly incorporate hydroacoustics sampling as a comparative tool to trawling every year.
2. Evaluate potential of using kokanee density estimates for predicting catch rates and catch size for the Anderson Ranch Reservoir population.
3. Continue bass monitoring at three-year intervals.

DIERKES LAKE

Abstract

Largemouth Bass *Micropterus salmoides* monitoring was completed on Dierkes Lake in 2011. We electrofished six, 15-minute transects and sampled a total of 186 bass. Mean CPUE (± 80% CI) for Largemouth Bass was 124 bass/h (± 27). Proportional stock density (PSD) was 12, with a RSD-Q of 88. Mean relative weights were 89 and 82 for stock and quality bass, respectively. Bass older than age 5 and larger than 305 mm (legal harvest length) were present in the sample, but in low numbers. Maximum age in the sample was 10 years. Population and conditional indices suggest the bass population is Dierkes Lake is comprised mostly of sub-stock fish of above-average condition.

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Introduction

Idaho Department of Fish and Game's (IDFG) Magic Valley Region manages many small public community fishing ponds. Most ponds receive significant fishing pressure based on their proximity to semi-urban and urban areas. IDFG views ponds as an important resource for providing accessible family fishing opportunities, which may help to recruit and retain new anglers (Balsman and Shoup 2008). Typically, these ponds are stocked with hatchery catchable Rainbow Trout *Oncohrynchus mykiss*, and support self-sustaining populations and angling opportunity for several warm water species including Bluegill *Lepomis macrochirus*, Channel Catfish *Ictalurus punctatus*, Largemouth Bass *Micropterus salmoides*, and Pumpkinseed *Lepomis gibbosus*.

Summer water temperatures at ponds are often not suitable for stocking trout, requiring a stocking cessation until waters cool in the fall (Hebdon et al. 2008). Unfortunately, stocking cessations at ponds coincide with peak fishing-effort periods. Stocking Bluegill and Largemouth Bass can be a popular strategy for sustaining fishing opportunities in ponds in portions of the country. However, IDFG does not currently have hatchery facilities designated for warmwater fish production. Because of this, warmwater fish populations depend on natural reproduction or translocation efforts. Despite IDFG's efforts to translocate warmwater species, little information currently exists to describe the warmwater species assemblage in Magic Valley ponds. Additionally, limited warmwater species stocking opportunities make monitoring these ponds an important priority. Furthermore, due to relatively high use at these ponds it is imperative IDFG manages the fishery to sustain robust family fishing opportunities.

Dierkes Lake is 20-acre, semi-urban community fishery located in Dierkes State Park, near Twin Falls, Idaho. Access to the lake is restricted to those who pay the daily or annual Idaho State Parks Pass fee. Dierkes Lake is stocked with hatchery Rainbow Trout during the late fall and early spring, but is primarily a Largemouth Bass fishery during the warmer months. Beginning in 1994, Dierkes Lake has been managed for trophy bass with a two-bass daily bag limit and 20-inch minimum length limit (508 mm). However, in 2010, this trophy regulation was rescinded, and replaced with general regulations (6-bass daily bag and 12-inch minimum length limits). This change was based on sampling observations of stunted centrarchid populations (Partridge and Warren 2001). The objective of this study was to sample Largemouth Bass to determine trends in relative population abundance, stock structure, fish condition, growth, and survival.

Methods

We characterized the bass population by sampling bass with boat electrofishing and calculating relative abundance (catch per unit effort; CPUE), stock structure, fish condition (W_r), fish growth (length-at-age), and fish survival (catch curve). Largemouth Bass were sampled on June 13, 2011, when Largemouth Bass are known to spawn on shallow nests (Heidinger 1975). We utilized boat electrofishing at six shoreline transects until 15 minutes was expended at each transect. Sample size goals for electrofishing units are based on the variance around the mean CPUE and power analysis. Sample size was determined real-time using Data Plus Solutions Software© (Cohen 1988), and was dependent on the variance of real-time CPUE. Sampling continued until the variation around the mean CPUE achieved 80% confidence (t-value = 1.26). Sampling occurred at night using a pulsed-DC (60 Hz) waveform and a 24% duty cycle (See Appendix B for gear description). Relative abundance was measured as average catch per unit effort (CPUE) and reported as fish/h. Sample sites were randomly selected throughout the reservoir (Appendix A).

Captured Largemouth Bass were measured for total length (TL) to the nearest millimeter, and weighed to the nearest gram. Otoliths were collected from up to five fish for each 10-mm length bin. Otoliths were prepared by centrally cracking and burning the broken edge with an alcohol burner; otoliths were coated in mineral oil and viewed at 30-40x magnification using a dissecting microscope (DeVries and Frie 1996). Mean length-at-age was calculated from each length bin. Fish growth was estimated by the mean-length-at-age summary using Fisheries Analysis and Simulation Tools, Version 2.1© (FAST).

Proportional stock density (PSD) was calculated to index the Largemouth Bass population size structure using FAST© software (Anderson and Neuman 1996). Relative weight (*W*r) was calculated in EXCEL© software and are reported as the mean *Wr*. Annual mortality and survival were estimated using a catch curve (Van Den Avyle 1993) generated in FAST© software. Stock structure was determined by the proportion of catch with length categorized as sub-stock (≤200 mm), stock (201-300 mm), and quality (≥301 mm).

Results

A total of 186 bass were collected from six, 15-minute sample unit locations. Mean CPUE for Largemouth bass was 124 (± 27, 80% CI). Length of Largemouth Bass ranged from 120 to 345 mm, compared to 45 to 395 mm in 2003 (Figure 10). Weight ranged from 5 to 528 g. A subsample of 78 bass were aged and included 7 age classes, with a maximum age of 10 years. Length-at-age 5 was 260 mm. There were six bass sampled in 2011 that exceeded the minimum length limit of 305 mm (Figure 10). Population and conditional indices suggest this bass population is dominated by sub-stock fish of below average relative condition. PSD was 12 (± 5, 95% CI) with a RSD-Q of 88. Mean relative weights were 89 for sub-stock- and 82 for stock-sized bass. Estimated annual mortality was 19%, derived from catch-curve regression (Figure 12).

Discussion

Two additional age classes were present in 2011 that were not present in 2003, which increased the maximum known age for this water from 7 to 10 years. Older age fish were abnormally small and averaged less than 300 mm. Largemouth Bass in Dierkes Lake are not meeting regional or North American length-at-age averages (Beamesderfer and North 1995). A multitude of variables may be affecting Largemouth Bass growth at Dierkes Lake. Poor physical habitat or water quality may be limiting growth. Similarly, lack of proper-size or adequate forage may be limiting growth of mid- and larger-sized bass. Comparing the two most recent surveys, bass catch rates remained similar at 116 (2003) and 124 fish/h (2011). These catch rates are indicative of a high-density population, so it is likely that crowding is the cause of poor growth. CPUE is nearly double the reported national averages (70 fish/h; Bonar et al. 2009). PSDs from 2011 suggest the Largemouth Bass population at Dierkes Lake is comprised primarily of sub-stock sized bass less than age 5. Unfortunately, no length-at-age or exploitation data was available from the 2003 survey for comparison. The poor growth rates exhibited here are limiting fisheries quality.

Recommendations

1. Determine the cause of poor growth rates by assessing prey populations, water quality, and physical habitat. Ameliorate factor(s) limiting growth.
2. Monitor bass population at three-year intervals.

DOG CREEK RESERVOIR

Abstract

A total of 88 Channel Catfish *Ictalurus punctatus* was tagged with t-bar achor tags (Floy ™) and released in Dog Creek Reservoir during 2011 to evaluate exploitation. Two tags were reported for an adjusted exploitation rate of 4%. However, 4% exploitation of catfish at Dog Creek Reservoir is comparable to those of stocked Channel Catfish in Northern Idaho, but considerably lower than those reported in Southwest Idaho.

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Introduction

Dog Creek Reservoir provides a diverse family-friendly fishing opportunity to South Central Idaho's rural communities. Dog Creek Reservoir is a 38-ha impoundment located approximately 10 km northwest of Gooding, Idaho. Dog Creek Reservoir is formed by an earthen dam and possesses an outflow controlled with a head-gate and manually-installed dam boards. Water in Dog Creek is impounded for the exclusive benefit of fish and wildlife with no irrigation drawdown. This results in little fluctuation in surface elevation.

An average of 3,000 fingerling Channel Catfish *Ictalurus punctatus* have been stocked annually in Dog Creek Reservoir since 1991. During 2003, staff began translocating adult Channel Catfish from the Snake River in addition to fingerling stocking. Poor performance from fingerling plants, reported low catch rates, and angler requests were the impetus for experimenting with adult translocations. Dog Creek Reservoir has not been surveyed in recent years, but has generally been considered to be an underperforming fishery. The objective of this study is to determine whether translocated adult catfish may improve this fishery.

Methods

Catfish were captured using baited trap nets. Seven trap nets were deployed during the nights of May 31 and June 1, 2011, for a total effort of 14 net nights. Nets were set in locations expected to provide high catch rates. Additional, catfish were collected with hook-and-line.

Captured catfish were measured for total length (mm) and weighed (g). Additionally, we inserted an orange floy tag into the dorsal musculature for purposes of estimating exploitation. All tagged fish were held overnight in a submerged cage to assess short-term tag loss. Tags possessed a tag reporting phone number and individual tag identification number. Anglers had the option of reporting tag information by phone (i.e. IDFG's Tag-You're-It Hotline, direct return by mail, or via a web portal. We queried the tag reporting database during November 2014. Unadjusted exploitation was calculated as the number of nonreward-tagged fish that were reported as harvested and divided by the number of fish that were released with non-reward tags (Meyer et al. 2012). There currently is not a reporting rate for tagged catfish in Idaho, thus we used Meyer et al. (2012) reporting rate for hatchery trout (53%). Adjusted exploitation was calculated by dividing the unadjusted exploitation rate by the estimated tag reporting rate from Meyer et al. (2012). Tag retention was assumed to be 100%.

Results

In total, 88 Channel Catfish were captured, tagged, and translocated to Dog Creek Reservoir. The total length of sampled Channel Catfish ranged from 110 to 510 mm (Figure 13). Two tags had been reported at the time of our tag return query in 2014, for an unadjusted exploitation of 2.2%. Assuming a 53% tag reporting rate, the adjusted exploitation of Channel Catfish in Dog Creek reservoir is 4.3%.

Discussion

Only two tags were reported from our tagging efforts, so the precision of the exploitation estimate was very low. The low number of tags could be a result of poor tag retention, low reporting rates, or low catch and harvest. Assuming tag retention and reporting rates were similar to statewide averages, results from this study suggest harvest of catfish in Dog Creek Reservoir is lower than other fisheries in southern Idaho (Butts et al. 2013). Catfish exploitation estimates suggest anglers are not aware of this fishing opportunity or have little interest or ability to catch catfish here. Low exploitation estimates (4%) in Dog Creek Reservoir are comparable to Channel Catfish exploitation in Northern Idaho (Fredericks et al. 2009). Our assumption of 100% tag retention was not accurate and should have been estimated. Retention of t-bar anchor tags in Channel Catfish is not consistent with some investigator reporting high retention rates (Haak 1987) and others low (Greenland and Bryan 1974). Even if our retention rates were more similar to Greenland and Bryan (1974), our conclusion (i.e. translocated Channel Catfish in Dog Creek Reservoir are underutilized) would not have changed. Efforts should be made to publicize this fishing opportunity with the intention of increasing utilization. If publicity efforts do not lead to increased interest, effort, or utilization, this effort should be discontinued.

Recommendations

1. Publicize Channel Catfish fishing opportunities in Dog Creek Reservoir.
2. Re-assess exploitation incorporating double tagging or methods known to have higher, more-consistent tag retention.

HAGERMAN WILDLIFE MANAGEMENT AREA

Abstract

During 2011, we utilized boat electrofishing techniques at two Hagerman WMA ponds to estimate abundance of Common Carp *Cyprinus carpio*. Carp abundance (± 95% CI) at Anderson Pond #2 and #4 was estimated as 1901 (± 443) and 533 (± 89), respectively. Furthermore, captured carp were removed from the population.

Angler use and catch was assessed all Hagerman WMA ponds using a formalized creel survey. Total angling effort for all ponds combined was 4,661 h (± 156). Total catch for all ponds and species combined was 4,708 fish. Estimated total harvest was 2,494 fish. Of anglers surveyed, 69% were shore anglers, and 31% were boat anglers.

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Introduction

The Hagerman Wildlife Management Area (WMA) is located in Gooding County, along Highway 30, south of the town of Hagerman, Idaho. The WMA is primarily managed for waterfowl; however, many small ponds provide diverse fishing opportunities. Anderson Ponds 1-4, West Highway Pond, Bass Pond 1-2, and Goose Pond all provide warmwater angling opportunity, while Riley Creek Pond and Oster Pond 1-6 are managed primarily as put-and-take trout fisheries. Because of the WMA's importance as a waterfowl refuge, fishing is prohibited from November 1 to the last day in February at Anderson Ponds 1-4, Oster Ponds 1-6, and Riley Creek Pond. Ponds are managed with general regulations.

Collectively, the Hagerman WMA Ponds are a popular local fishing destination, in part due to the multiple IDFG-hosted fishing events. Understanding angler effort and harvest is important to maintaining and meeting the demands of the fishery. Because of popularity, staff monitors aspects of the fish community including species composition, size structure, and relative abundances with semi-regular monitoring. Common Carp *Cyprinus carpio* have been encountered at higher rates in recent sampling years (Ryan and Megargle 2005). Common carp are known to negatively affect water quality and fisheries when well established. Managers often desire to suppress carp abundance to reduce these negative effects. The objectives of this study were to estimate carp abundance at Anderson Pond 2 and 4, estimate angler effort, catch, and harvest for all species in all ponds, as well as to suppress Common Carp.

Methods

Creel Survey

A partial-year, angler creel survey was completed at Hagerman WMA from July 1 to October 31, 2011. We completed angler counts and interviews on 14 randomly-selected days, including 10 non-holiday weekdays and 4 weekend/holiday days. We stratified days into two equal duration shifts and randomly-selected one shift per sampling day. Shift times for the AM and PM shifts were 8 am - 2 pm and 2 - 8 pm, respectively. Angler counts were collected on foot, at available access sites, and by boat. One instantaneous effort count was completed at a randomly-selected time for each survey date. Extrapolated angling effort (E) for all waters combined was calculated by using the equation,

$$E = t(ch)$$

Where t is the total days in the census period, c is the mean daily angler count, and h is the mean daily hours fished. Catch and harvest data were obtained from angler interviews and were applied to the extrapolated catch data. Total catch or harvest was estimated by multiplying the catch or harvest per hour by E.

Common Carp

We completed a mark-recapture effort to estimate the size of the Common Carp populations in Anderson Pond #2 and #4. We sampled carp at night using boat electrofishing techniques. We electrofished along shoreline transects for a duration of 15 minutes. The electrofishing waveform consisted of pulsed-DC (60 Hz) and a 24% duty cycle (See Appendix B for gear description). Two electrofishing efforts, separated by seven days, were completed at each location to mark and recapture fish. All carp captured during the initial marking run were measured for total length to the nearest mm weighed to the nearest g. Captured carp were marked with a caudal fin punch and released. Carp captured during the recapture run were counted, measured to the nearest mm, examined for marks, and then removed from the population.

Results

Common Carp

A total of 245 carp were sampled, marked, and released at Anderson Pond #2 on April 19, 2011. During the recapture run, a total of 433 carp were sampled on April 26, 2011. The abundance of carp in Anderson Pond #2 was 1,901 (± 443, 95% CI). Total length of carp ranged from 340 to 690 mm (Figure 14). For Anderson Pond #4, a total of 181 carp were marked on March 29, 2011. During the recapture run, a total of 257 carp were sampled on April 5, 2011. The abundance of carp in Anderson Pond #4 was 533 (± 89, 95% CI). Total length of sampled carp ranged from 310 to 780 mm (Figure 14).

All carp collected during recapture runs were removed. We completed additional carp removals at Anderson Pond #2 in late April and May. A total of 810 carp were removed or 42% of the population. Also, we completed additional carp removals at Anderson Pond #4 in late April and May. A total of 443 carp were removed or 83% of the estimated population.

Though no carp population abundance estimates were available for Anderson Pond #1 and West Highway Pond, we completed carp removals there as well. We removed a total of 164 carp from the West Highway Pond. Total length of removed carp ranged from 505 to 855 mm (Figure 14). We removed a total of 59 carp from Anderson Pond #1. Total length of removed carp ranged from 365 to 765 mm (Figure 14).

Creel Survey

Total angler effort for all Hagerman WMA ponds combined was 4,661 h (± 156, 80% CI; Table 6). Mean angler catch rate was 1.01 fish/h. Total catch and harvest were 4,708 and 2,494 fish, respectively (Table 7). Of anglers surveyed, 10% used fly gear, 34 % used lures, and 55% used bait. Anglers primarily fished from shore (70%) compared to by boat (30%).

Discussion

Results indicate angler use of Hagerman ponds during this four-month period was relatively low despite catch rates of about one fish per hour. Effort and catch have declined substantially from 1984 when a similar study was completed (Grunder et al. 1986). During 1986, effort and catch were 23,958 h and 23,882 fish. Catch consisted of 15,661 Rainbow Trout (66%), 1,218 Largemouth Bass (5%), 5,600 Bluegill (23%), and 1,403 other species (6%; bullhead and Yellow Perch). The substantial decline in effort comparing the 1984 to 2011 surveys is concerning. The exact cause of this decline is unknown, but possibilities include reduced survival of hatchery RBT during summer due to temperature or bird predation or the establishment of Common Carp. Further investigation is needed to determine likely causes of this decline. Furthermore, it is important to note that this creel only characterized effort for a 4-month period. Total effort was likely much higher as the vast majority of fishing effort occurs prior to July in other community fishing waters. Future creel surveys should be designed to estimate total annual effort.

Recommendations

1. Complete mark-recapture population efforts for Largemouth Bass and Bluegill.
2. Determine use and exploitation rates for stocked Rainbow Trout.
3. Determine whether physical carp suppression efforts are sufficiently effective to allow maintenance of quality bass and Bluegill fisheries.
4. If physical suppression is ineffective, determine whether chemical control of Common Carp could be completed efficiently.

MILNER RESERVOIR

Abstract

During 2011, we monitored Smallmouth Bass *Micropterus dolomieu* in Milner Reservoir using boat electrofishing methods. A total of 346 Smallmouth Bass were sampled. Mean catch per unit effort was 92 bass/h (± 21, 80% CI). PSD was 39 with a RSD-Q of 61. Mean relative weights for stock- and quality-sized bass was 91 and 84, respectively. Estimated annual mortality was 27%. Catch rates of Smallmouth Bass rates were relatively high compared to other fisheries in the Magic Valley Region.

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Introduction

Smallmouth Bass *Micropterus dolomieu* angling is popular in southern Idaho, and seems to be increasing in popularity according to the statewide angler opinion survey. Milner Reservoir is a 760-ha impoundment of the Snake River located near the town of Burley, Idaho. It is managed primarily as an irrigation reservoir storing water for release into the Milner-Gooding, Twin Falls, and North Side canals. Smallmouth Bass and Channel Catfish *Ictalurus punctatus* are the primary game fish. Historically, Milner Reservoir was not known as a quality Smallmouth Bass fishery. However, more consistent water levels, quality regulations, and more favorable temperature regimes have resulted in a quality fishery. The objective of this study is to collect and asses Smallmouth Bass in Milner Reservoir and compare findings with past data and other systems.

Methods

We sampled Smallmouth Bass with boat electrofishing at night. We calculated common fisheries metrics including relative abundance or catch per unit effort (CPUE), stock structure, fish condition (W_r), fish growth (length-at-age), and survival (catch curve). Sampling occurred on June 13, 2011 when bass are known to frequent shallow areas for purposes of spawning (Heidinger 1975). We sampled 15 shoreline transects for 15 minutes each. Sample size goals for electrofishing units are based on the variance around the mean CPUE and power analysis. Sample size was determined real-time using Data Plus Solutions Software© (Cohen 1988), and was dependent on the variance of real-time CPUE. Sampling continued until the variation around the mean CPUE achieved 80% confidence (t-value = 1.26). Sampling using a pulsed-DC (60 Hz) waveform and a 24% duty cycle (See Appendix B for gear description). Relative abundance was measured as average catch per unit effort (CPUE) and reported as fish/h. Captured Smallmouth Bass were measured for total length (TL) to the nearest millimeter, and weighed to the nearest gram.

Otoliths were collected from 5 fish for each 10-mm length bin present during the sampling effort. Otoliths were prepared by centrally cracking and burning the broken edge with an alcohol burner; otoliths were coated in mineral oil and viewed at 30-40x magnification using a dissecting microscope (DeVries and Frie 1996). Mean length-at-age was calculated for each length bin. Fish growth was estimated by the mean-length-at-age summary using Fisheries Analysis and Simulation Tools, Version 2.1© (FAST).

Proportional stock density (PSD) was calculated to index the Smallmouth Bass population size structure using FAST© software (Anderson and Neuman 1996). Relative weight (*Wr*) was calculated in EXCEL© software and are reported as a mean. Annual mortality and survival were estimated using a catch curve (Van Den Avyle 1993) generated in FAST© software. Size structure was calculated based on the following categories: sub-stock (≤ 200 mm), stock (201-300 mm), and quality (≥ 301 mm).

Results

We sampled a total of 346 Smallmouth Bass. Mean CPUE was 92 bass/h (± 21, 80% CI). Total length of sampled bass ranged from 60 to 425 mm with a mean length of 202 (± 4 mm, Figure 15). We sampled primarily stock-sized SMB. Proportional stock density was 39 (± 8, 95% CI), and RSD-Q was 61. Mean relative weight for stock- and quality-sized bass was 91 and 84, respectively. Estimated annual mortality was 27 % (Figure 16). Estimated annual mortality was considered low to moderate relative to other regional Smallmouth Bass fisheries. Theoretical maximum age was 15 years.

Discussion

Relative abundance in Milner Reservoir was higher than for other nearby populations and is nearly two fold higher than the national average of 52.7 fish/h for large standing waters (Bonar et al. 2009). However, proportional stock density and RSD-Q were lower than national averages. Condition of stock and quality-sized bass were below national averages as well. Compared to sampling in 2009 (Stanton et al. 2009), relative abundance was similar to 2011. Note: a mistake was identified in the calculation of CPUE in Stanton et al. (2009) and has since been recalculated and presented here. CPUE in 2009 was 74 bass/h (± 18, 80% CI), whereas in 2011 CPUE was 92 bass/h (Table 8). Additionally, PSD and mean length-at-age 5 increased compared to 2009, suggesting that condition and growth rates have increased since the previous survey.

Recommendations

1. Continue bass monitoring at three-year intervals.
2. Estimate exploitation of Smallmouth Bass at Milner Reservoir to estimate fishing mortality.

SALMON FALLS CREEK RESERVOIR

Abstract

We monitored the Smallmouth Bass *Micropterus dolomieu* population in Salmon Falls Creek Reservoir using boat electrofishing methods. During 2011, we sampled a total of 387 Smallmouth Bass. Mean catch per unit effort was 129 bass/h (± 37; 80%CI). PSD was 21 with a RSD-Q of 79. Mean relative weight for stock- and quality-sized bass was 94 and 85, respectively.

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Introduction

Salmon Falls Creek Reservoir (SFCR) is a 1,376-ha irrigation impoundment located on Salmon Falls Creek in Twin Falls County, ID. SFCR is unique to the Magic Valley Region in that a relatively-large, inactive storage capacity exists, allowing for better fish carryover and productivity even in low water years. The reservoir is managed as a mixed-species fishery for Rainbow Trout *Oncorhynchus mykiss*, Yellowstone Cutthroat Trout *Oncorhynchus clarkii bouvieri* Walleye *Sander vitreus*, Yellow Perch *Perca flavescens*, Smallmouth Bass *Micropterus dolomieu*, and Black Crappie *Pomoxis nigromaculatus.* In recent history, Salmon Falls Creek Reservoir was managed for kokanee *Oncorhynchus nerka*; however, this species never became abundant likely due to Walleye predation. Kokanee stocking was discontinued after 2009. Currently, SFCR is one of only three waters in Idaho managed for Walleye.

Most angling effort at SFCR is directed at Walleye and Yellow Perch. However, anglers have begun to show some interest in Smallmouth Bass and during a recent creel survey, Smallmouth Bass was the third most targeted species (Stanton et al. 2009). This trend is common for several Magic Valley fisheries with apparently increasing interest in Smallmouth Bass angling. Smallmouth Bass were last monitored at Salmon Falls Creek Reservoir in 2008. Our objective was to sample the Smallmouth Bass population in SFCR to assess and monitor common fisheries metrics including relative abundance (catch per unit effort, CPUE), stock structure (Proportional Stock Structure, PSD), length-at age as an index of growth, and relative weight as an index of condition.

Methods

We sampled Smallmouth Bass with boat electrofishing at night. We calculated common fisheries metrics including relative abundance or catch per unit effort (CPUE), stock structure, fish condition (W_r), fish growth (length-at-age), and survival (catch curve). Sampling occurred on June 28-30, 2011 when bass are known to frequent shallow areas for purposes of spawning (Heidinger 1975). We sampled 12 shoreline transects for 15 minutes each. Electrical waveform consisted of pulsed-DC (60 Hz) and a 24% duty cycle (See Appendix B for gear description). Relative abundance was reported as mean CPUE in fish/h. Captured Smallmouth Bass were measured for total length (TL) to the nearest millimeter, and weighed to the nearest gram.

Otoliths were collected from 5 fish for each 10-mm length bin present during the sampling effort. Otoliths were prepared by centrally cracking and burning the broken edge with an alcohol burner; otoliths were coated in mineral oil and viewed at 30-40x magnification using a dissecting microscope (DeVries and Frie 1996). Mean length-at-age was calculated for each length bin. Fish growth was estimated by the mean-length-at-age summary using Fisheries Analysis and Simulation Tools, Version 2.1© (FAST).

Proportional stock density (PSD) was calculated to index the Smallmouth Bass population size structure using FAST© software (Anderson and Neuman 1996). Relative weight (*Wr*) was calculated in EXCEL© software and are reported as a mean. Annual mortality and survival were estimated using a catch curve (Van Den Avyle 1993) generated in FAST© software. Size structure was calculated based on the following categories: sub-stock (≤ 200 mm), stock (201-300 mm), and quality (≥ 301 mm).

Results

A total of 387 Smallmouth Bass were sampled. Mean CPUE for Smallmouth Bass was 129 fish/h (± 37, 80% CI). Total length of sampled fish ranged from 45 to 350 mm, with a mean length of 169 mm (± 4, Figure 17). Average weight was 98 g (± 10). Mean length-at age indicated it takes approximately five years to attain 226 mm (Figure 18). Estimated maximum length and age were 9 years and 340 mm. PSD was 23 (± 4, 95% CI) with a RSD-Q of 78 (Table 8). Mean relative weight for stock- and quality-sized bass was 94 and 85, respectively. Population indices suggest the Salmon Falls Creek Reservoir's Smallmouth Bass population was almost entirely comprised of stock or sub-stock sized fish. Estimated annual mortality was 16 % (Figure 19).

Discussion

Relative abundance of Smallmouth Bass in SFCR has declined recently. Comparing 2008 to 2011, CPUE declined from 241 to 129 fish/h. PSD and mean length also decreased from 2008. Contrastingly, mean length-at age was higher in 2011 compared to 2008. During 2011, a total of nine age classes were sampled, whereas only seven age classes were sampled in 2008. Mean relative weight of stock-sized bass increased marginally from 91% in 2008, to 94% in 2011. Mean relative weight for quality-sized bass also increased from 64% in 2008 to 85% in 2011. Observed length-at-age in 2011 was comparable to a statewide average reported by Dillon (1992) and comparable to Warren et al. (2001). Indices indicate this bass population is relatively low density and slow growing.

Recommendations

1. Periodically assess Smallmouth Bass population every three years specifically growth, condition, and determine whether forage availability is limiting growth.
2. Complete tagging study to measure catch and exploitation of Smallmouth Bass.

BILLINGSLEY CREEK

Abstract

Brown Trout *Salmo Trutta* are stocked into Billingsley Creek to provide fishing opportunity. Recent information about survival, use, and exploitation for these fish is unavailable. During 2011, we tagged and released 231 hatchery Brown Trout averaging 192 mm total length. No tags were reported within one year post release; and therefore, survival, use, and exploitation are thought to be very low.

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Introduction

Billingsley Creek is 13.6-km long cold-water spring creek that flows into Lower Salmon Falls Reservoir - a Snake River impoundment near the town of Hagerman, Idaho. Billingsley Creek's fish populations have been affected by a variety of anthropogenic perturbations including development of hydroelectric plants and hatcheries, as well as from adjacent ranching and farming operations. Despite these large-scale effects, the creek provides a Brown Trout *Salmo trutta* and Rainbow Trout *Oncorhynchus mykiss* fishery that is suspected to be primarily of hatchery origin. Brown Trout have been stocked in Billingsley Creek since the early 1970s, initially as fry. Over time, managers have increased size at stocking. During the 1980s and 1990s, mostly fingerling-sized Brown Trout were stocked. Beginning in 2003 and through 2011, mostly catchable-sized Brown Trout were stocked. Hatchery trout in Billingsley Creek originate from direct plants by Idaho Department of Fish and Game (IDFG) hatcheries or by escaping from private commercial aquaculture facilities. Natural reproduction is thought to be limited to nonexistent, but this notion has not been specifically assessed. In addition, hatchery White Sturgeon *Acipenser transmontanus* and yellow-phase Rainbow Trout are occasionally present.

A large portion of Billingsley Creek is inaccessible to the general public as most lands adjacent to the creek are privately owned. Recently, IDFG has completed several projects to improve access for anglers. Unfortunately, anecdotal reports from anglers indicate that catch rates are relatively low. We initiated a tagging study to gather information about the performance of stocked Brown Trout. Specifically we sought to estimate use and exploitation.

Methods

Catchable-sized Brown Trout were reared at the American Falls Hatchery, anesthetized with MS-222, measured for total length, and tagged with t-bar anchor tags according to the methods described in Meyer et al. (2012). A total of 231 Brown Trout were tagged, including 25 fish that were double tagged and 25 fish that were tagged with $50 reward tags, to estimate shed and reporting rates (Meyer et al. 2012). Tags included a phone number for IDFG's Tag-You're-It! Hotline and an individual tag number. In addition, anglers could report tags on the IDFG website at or local offices. Fish were held for a 21-d withdrawal period prior to stocking during October 2011 into lower Billingsley Creek on the Hagerman WMA.

Results

We tagged and released 231 Brown Trout averaging 192 mm. After 365 d post release, we queried the Tag-You're-It! Database. No tag had been reported from Billingsley Creek from this release group.

Discussion

After 365 days at large, no tags were reported from Brown Trout stocked during 2011. As a result, use and exploitation were assumed to be very low. Survival and exploitation of stocked trout can be greatly impacted by the size of fish at release (Cassinelli and Meyer 2018), and the average size of stocked Brown trout for this study was well below IDFG's standard length for catchables (250 mm). At least one investigator has reported high tag retention and survival for Brown Trout tagged with t-bar anchor tags (O'Grady 1984), therefore, we assume that tag loss or tagging-related mortality did not affect our studies results. A number of other factors may have influenced our lack of tag reports. Access to Billingsley Creek is very limited. It is mainly a float fishery, with anglers using boats, canoes, and other small watercraft. Very little use data is available for this fishery, and population sampling is difficult because of the nature (i.e. water depth) of the habitat which makes sampling difficult. Stocked trout may disperse out of the study reach which may have limited the encounter rate by anglers (Young et al. 1997), especially if they migrated upstream to where the banks are privately owned.

Survival or utilization of Brown Trout stocked in Billingsley Creek during 2011 was unacceptably low. Staff need to determine whether stocking practices may be modified or angler access improved sufficiently to allow sufficient utilization of hatchery resources. For instance, staff should investigate whether alternate species, timing, stocking locations, or size at stocking might improve survival or utilization. In addition, staff should publicize this resource. If substantial improvements aren't realized, stocking should be discontinued.

Recommendations

1. Alter stocking timing, locations, size at release, or species to determine if alternate stocking practices will improve survival or utilization.
2. Publicize stocking events, access locations, and this fishing opportunity.
3. Repeat tagging studies with altered stocking practices
4. Conduct a creel survey to estimate catch rates, catch composition, and angler effort at Billingsley Creek.

SIXMILE CREEK

Abstract

Yellowstone Cutthroat Trout (YCT) *Oncorhynchus clarkii bouvieri* were thought to be extirpated from Sixmile Creek, a small tributary of the upper Raft River in Southern Idaho. We sought to re-establish a population of genetically-pure YCT in Sixmile Creek. A rotenone treatment was completed during 2009 to eliminate Rainbow Trout *Oncorhynchus mykiss* and hybrids *O. mykiss* X *O clarkia.* During May 2010, we collected 83 adults from Eightmile Creek, a nearby stream, and translocated them to Sixmile Creek. In November 2011, an additional 54 YCT were collected from Eightmile Creek and transplanted to Gunnel Reservoir, located in the Sixmile Creek drainage. During May 2011, we sampled Sixmile Creek upstream of Gunnel Reservoir using backpack electrofishing units.

During May 2011 sampling of Sixmile Creek, YCT were present in all three, 100-m transects. Mean catch per unit effort (CPUE) for Sixmile Creek was 3 YCT/100 m. Because both creeks have similar habitat quality and size, and Eightmile has higher densities of YCT, we conclude that the population in Sixmile Creek has not reached full carrying capacity. We recommend continued monitoring and the completion of additional translocation efforts during 2012. Staff should consider utilizing an alternative donor population to reduce demographic or genetic impacts to donor or source populations.

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Introduction

Sixmile Creek is an isolated tributary within the Raft River drainage in Cassia County, Idaho. It is a spring-fed system that typically sustains a discharge of approximately 0.05 m^3/sec for 1.8 km before it is impounded to create Gunnel Reservoir (aka Sixmile Reservoir). The creek and impoundment are located on and are managed by the United States Forest Service, Sawtooth National Forest, and Cassia Ranger District. Coordinates are found in (Appendix A). The drainage is characterized as high-elevation shrub steppe. Dense juniper stands exist in the riparian corridor. Portions of this drainage are suitable habitat for Yellowstone Cutthroat Trout *Oncorhynchus clarkii bouvieri* (YCT; Ryan and Megargle 2006). Prior to 2009, Rainbow Trout *Oncorhynchus mykiss* and Hybrid Trout *O. clarkii* × *O. mykiss* had become established, leading to genetic introgression of native YCT. A rotenone treatment was completed during 2009 to eliminate non-native trout. Idaho Fish and Game considers conservation of Yellowstone Cutthroat Trout (YCT) a high priority (IDFG 2007). Accordingly, we initiated efforts to reintroduce and re-establish self-sustaining populations of YCT into Sixmile Creek by translocating adults from nearby drainages.

Methods

YCT were collected from Eightmile Creek with backpack electrofishing units using pulsed direct current. Collected trout were measured for total length (mm), and weighed (g). A small fin sample was collected from each trout to determine genetic composition. During 2010, a total of 83 adult pure strain YCT were collect from Eightmile Creek and transplanted to Sixmile Creek in an effort to re-establish a population in this creek. During November 2011, an additional 54 YCT were collected from Eightmile Creek and transplanted to Gunnel Reservoir. Length of translocated YCT ranged from 48 to 248 mm (Figure 21), and included multiple age classes.

On May 17, 2011, we sampled Sixmile Creek upstream of Gunnel Reservoir with backpack electrofishing units to determine the effectiveness of prior YCT translocation efforts. We utilized a pulsed-DC waveform and maximum output. We sampled three, 100-m transects, and all sampled YCT were measured, weighed, and returned to the creek.

Results and Discussion

During 2011, YCT were present in all three, 100-m transects in Sixmile Creek, and a total of 16 YCT were sampled. For this effort, mean CPUE was 3 YCT/100 m. Comparatively, relative abundance in Eightmile Creek during 2010 appeared much higher. Because both creeks have similar habitat, flow, and temperature regimes, the low CPUE at Sixmile Creek suggests this population has not reached full carrying capacity. We recommend additional translocation efforts during future years including from a different donor population to ensure that genetic diversity is maximized. YCT collected at Sixmile Creek ranged from 84 to 315 mm (Figure 20). Multiple age classes were likely represented. We observed gravid females and active redds from the source population, suggesting 2011 translocated YCT would likely to reproduce.

Recommendations

1. Transplant an additional 100 YCT from adjacent, genetically-pure populations, possibly Almo Creek or Cottonwood Creek, to (further) establish a self-sustaining cutthroat trout population with sufficient genetic diversity.
2. Monitor abundance and genetic composition of trout population(s) in Sixmile Creek to determine whether past efforts were effective.
3. Sample Gunnel Reservoir to determine if YCT utilize the reservoir and provide some fishing opportunity.

SOUTH FORK BOISE RIVER

Abstract

During fall 2011, we completed mark-recapture population estimates for Rainbow Trout *Oncorhynchus mykiss*, Mountain Whitefish *Prosopium williamsoni*, and Bull Trout *Salvelinus confluentus* in the upper mainstem South Fork Boise River (SFBR). A total of 215 target specimens were collected and included 105, 80, and 30 Rainbow Trout, Mountain Whitefish, and Bull Trout , respectively. Linear densities for 37 Rainbow Trout / 100 m, and 19 Mountain Whitefish / 100 m were estimated. Overall population estimates of both Rainbow Trout and Mountain Whitefish were the lowest recorded since sampling began in 1991.

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Introduction

The SFBR possesses two distinct riverine fisheries separated by Anderson Ranch Reservoir and Dam. The popular lower SFBR is primarily a tailwater fishery for trophy-sized Rainbow Trout. It is located immediately downstream of Anderson Ranch Dam and is managed by the IDFG Southwest Regional Office. The upper SFBR (i.e. upstream of Anderson Ranch Reservoir) is managed as a mixed fishery primarily for wild and hatchery-produced Rainbow Trout. This reach is managed by the IDFG Magic Valley Regional Office and is the focus of this evaluation.

The South Fork Boise River (SFBR) upstream of Anderson Ranch Reservoir (ARR) flows mostly through U.S. Forest Service lands in Elmore and Camas counties. Road access to the SFBR between Pine, ID and Big Smoky Creek is adequate, easily allowing anglers to access most of this river section with only a short walk. The fishery in the 39-km reach of SFBR from the bridge at Pine upstream to the Beaver Creek confluence is managed with general fishing regulations allowing a daily bag limit of six trout of any size. The 16-km reach from Beaver Creek upstream to the Big Smoky Creek confluence has been managed since 1992 with a two trout bag limit, none less than 14 inches long (356 mm), and gear is restricted to artificial flies and lures only and single barbless hook only. The reach upstream from Big Smoky Creek, including all tributaries, is also managed with general rules. Both reaches that are managed with general rules are stocked with catchable-sized Rainbow Trout *Onchorhynchus mykiss* to provide put-and-take fishing opportunity. Since January 1, 1996, there has been no open season for Bull Trout *Salvelinus confluentus*, which are present in the South Fork Boise River. Kokanee *Onchorhynchus nerka* also migrate upstream from Anderson Ranch Reservoir to spawn in the the SFBR and tributaries from late August to early October.

The objective of this sampling effort was to complete population estimates on the upper SFBR to monitor population trends and evaluate the efficacy of differing management strategies and regulations. Sampling of the SFBR to monitor population trends is completed triennially. These sampling efforts target the three main sportfish present in the SFBR including Rainbow Trout (RBT), Mountain Whitefish (MWF) *Prosopium williamsoni*, and Bull Trout (BLT).

Methods

We used an inflatable canoe equipped with an MLES DC pulsating electro-fisher unit, and shocked at maximum output. A description of equipment used in standard stream surveys is listed in (Appendix B). We electro-fished three, 300-m transects in a downstream fashion. Sites were located in all differing regulation sections of the upper SFBR.

We estimated trout abundance using mark-recapture techniques, with one marking run and one recapture run separated by seven days. During the marking run, fish were identified to species, measured for total length, weighted, and marked with a upper caudal hole punch. During the recapture run, we identified species, measured length, and examined fins for a mark. All sampled fish were released back to their respective stream reach. Due to low detection probability, trout shorter than 100 mm were not marked (or included in abundance estimates), but were included in the total catch per unit effort index (CPUE).

Abundance estimates for Rainbow Trout and Mountain Whitefish were made using a modified Peterson mark-recapture estimator (Ricker 1975). Estimates were summarized in 100-mm length bins for fish equal or greater than 100 mm. A minimum of five recaptures for each length bin was required for estimation. Length bins with catches less than five were pooled with the next greatest length bin.

Average wetted stream widths for each transect were measured the week following recapture runs to allow calculation of density for each target species. Transect widths were measured with a Leica LRF 900 Rangemaster rangefinder at 10 randomly-selected locations within each electro-fishing transect. Transect waypoints were marked for future replication using a Magellan Sporttrack Topo GPS (Appendix A).

Results

A total of 215 target specimens were sampled including 105, 80, and 30 Rainbow Trout, Mountain Whitefish, and Bull Trout, respectively. Total length of Rainbow Trout ranged from 111 to 390 mm (Figure 23), and weight ranged from 15 to 646 g. Length of Mountain Whitefish ranged from 90 to 443 mm, and weight ranged from 6 to 681 g (Figure 24). Length and weight of Bull Trout ranged from 185 to 476 mm (Figure 22) and from 48 to 1,038 g, respectively.

A total of 57 RBT and 44 MWF were marked; and, 48 RBT and 35 MWF were recaptured. Abundance for all transects combined was 405 RBT (± 244), and 230 MWF (± 145, Table 9). These estimates equate to linear densities of 37 RBT / 100 m and 19 MWF / 100 m (Table 10). Bull Trout catch was too low and prevented calculation of abundance estimates.

Discussion

The Rainbow Trout and Mountain Whitefish population estimates for 2011 were the lowest recorded since sampling began in 1991. However, there was some concern that electrofishing inefficiency may have contributed to or been the entire cause of this conclusion. Two initial attempts were made with the raft electroshocking unit. Both attempts failed to produce enough amperage to effectively sample fish in the SFBR. The sampling was finally completed using a canoe electrofishing unit. Catch was lower than in previous years during both the mark and recapture runs. A steady current of 1-2 amps was all that could be generated. In past sampling efforts conducted on the SFBR, 3 amps were used. Avoidance to the sampling gear was noted in 2011 sampling. Capture probabilities for RBT and MWF were 10.5% and 13.6%, respectively, lowering our confidence in these estimates. Historical trends (1991-2011) indicated abundance of the South Fork Boise River's Rainbow Trout has been relatively stable, though the 2011 estimate was the lowest in this data set. Contrastingly, abundance of MWF has declined markedly since 1991. Catch composition in the SFBR in 2011 standard stream survey was comparable to that of other surveys completed between 1991- 2008.

Implementation of quality trout regulations within the middle sample reach (2 trout; limit none under 14") would hopefully lead to a size structure comprised of more trout longer than > 14" (355 mm) than in reaches managed with general regulations. However, few quality-sized trout were sampled. There are several possible explanations for this observation including seasonal trout migration, insufficient growth rate, or lack of compliance. Future assessment should attempt to gain better understanding into these and other factors related to trout size structure. Development of angler use and exploitation estimates would increase our understanding of how anglers utilize fish in this reach of the SFBR.

Recommendations

1. Continue triennial trend monitoring of the SFBR; ensure electrofishing unit outputs are adequate to provide better capture efficiencies.
2. Assess utility of current regulation framework by assessing age-and-growth, movement, compliance, and public opinion.
3. Complete tagging study to determine angler use and exploitation of stocked RBT.

FIGURES

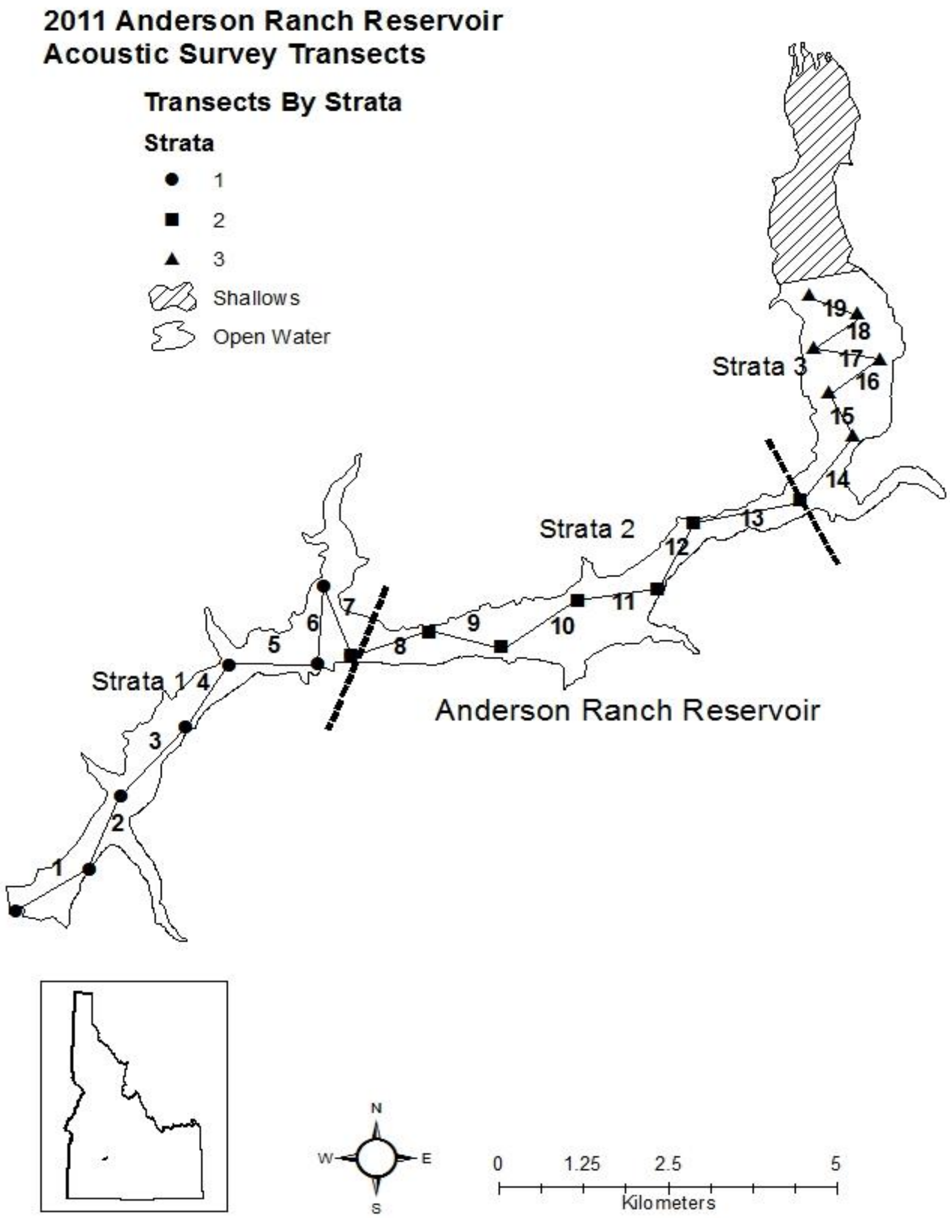


Figure 1 Map of Anderson Ranch Reservoir, Idaho, depicting transects used in the hydroacoustic survey in each strata on August 3 and 4, 2011.

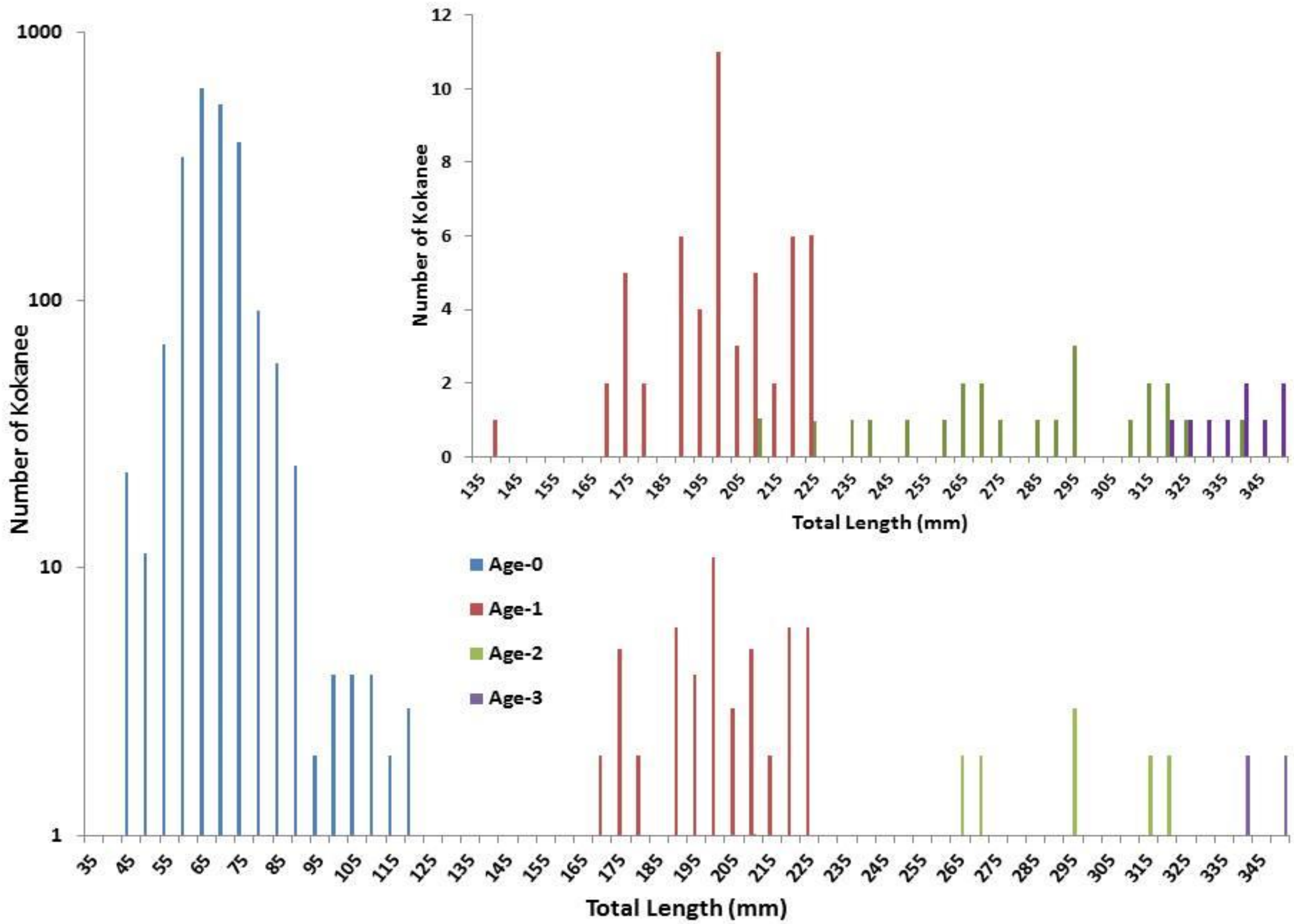


Figure 2. Catch and age-at-length (mm TL) of kokanee in Anderson Ranch Reservoir during midwater trawl surveys (July 27-28, 2011). Main y-axis is on a log scale in order to show high abundance of fry. Inset reveals overlap in age-at-length, ages 1-3.

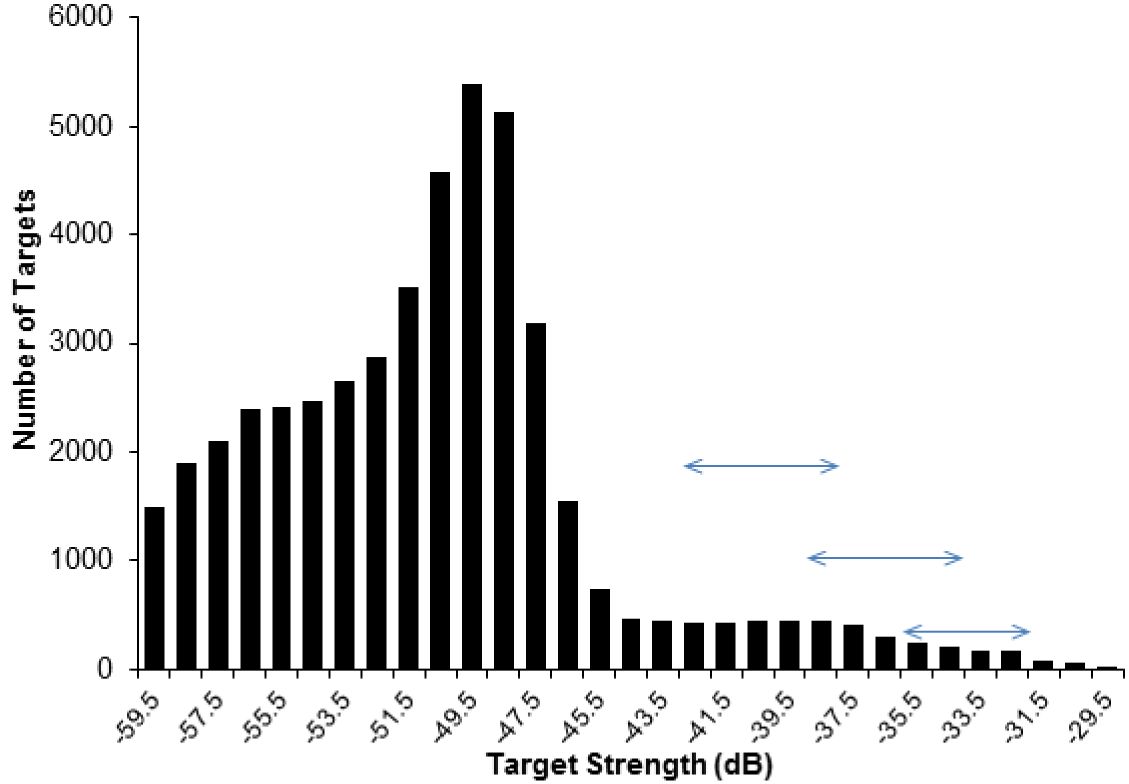


Figure 3. Fish Target Strength Frequency distribution recorded during hydroacoustics assessment of ARR, August 1-2, 2011.

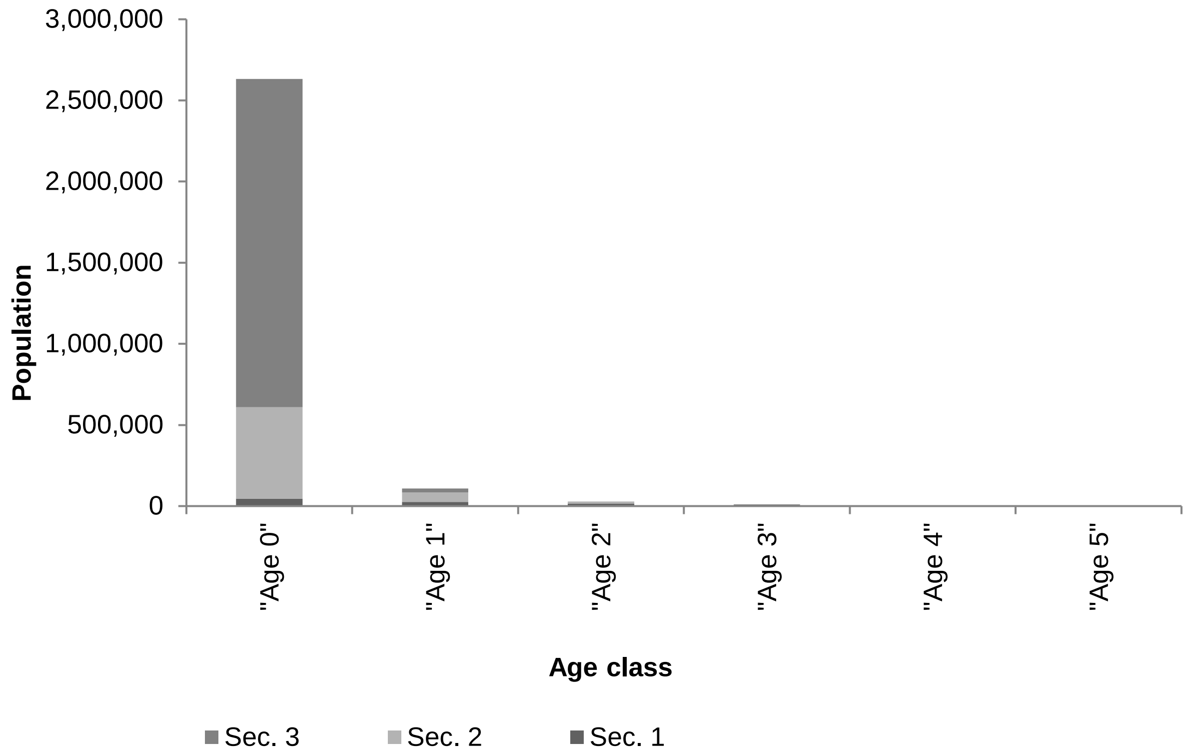


Figure 4. Anderson Ranch Reservoir trawl catch by age class completed in 2011.

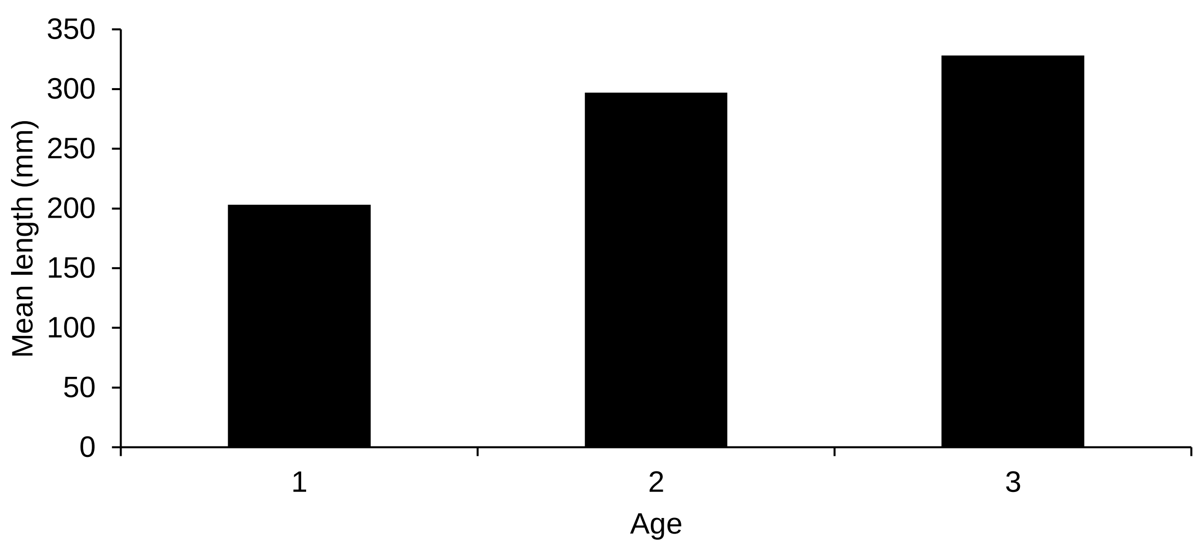


Figure 5. Mean length-at-age (*n* = 90), of kokanee sampled from Anderson Ranch Reservoir during 2011 with a trawl.

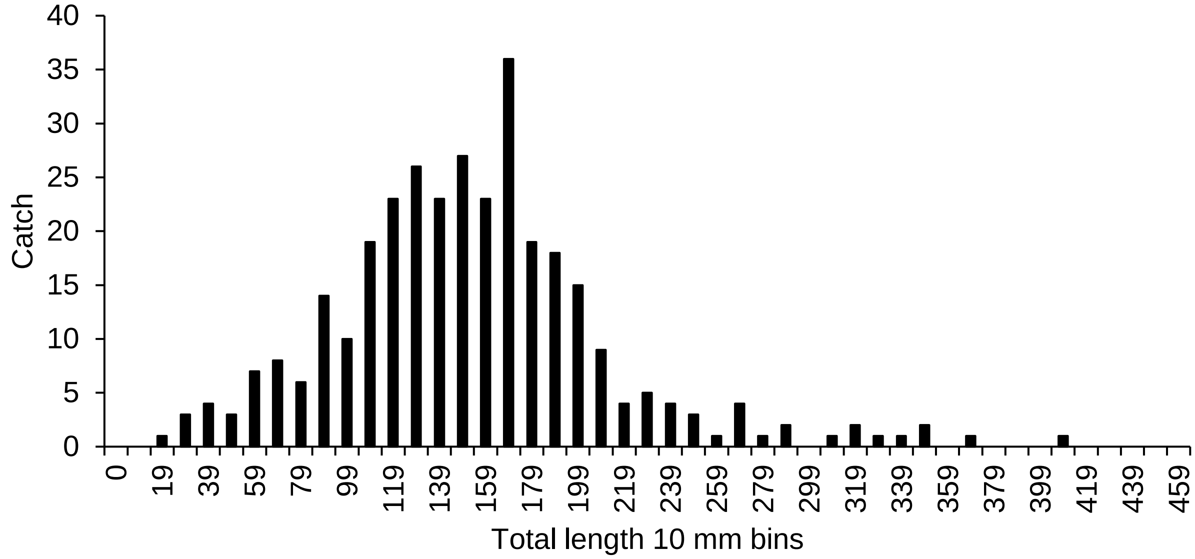


Figure 6. Length-frequency histogram for Smallmouth Bass (*n* = 549) sampled in ARR in 2011 with electrofishing.

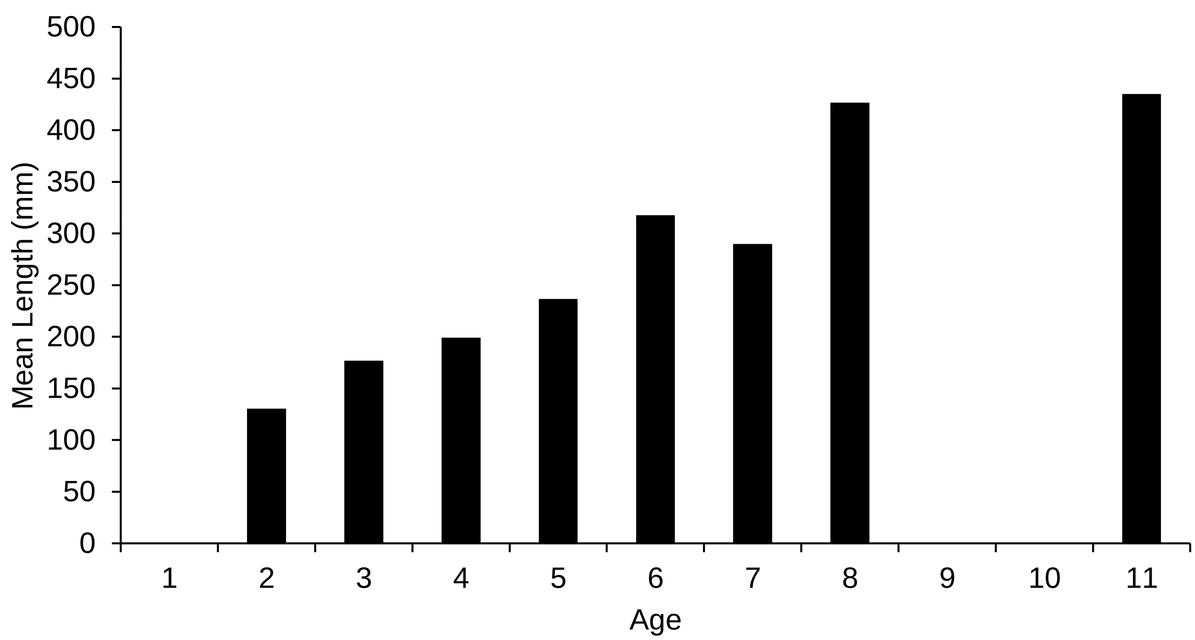


Figure 7. Mean length-at-age of Smallmouth Bass (*n* = 171) from Anderson Ranch Reservoir sampled during 2011 with electrofishing.

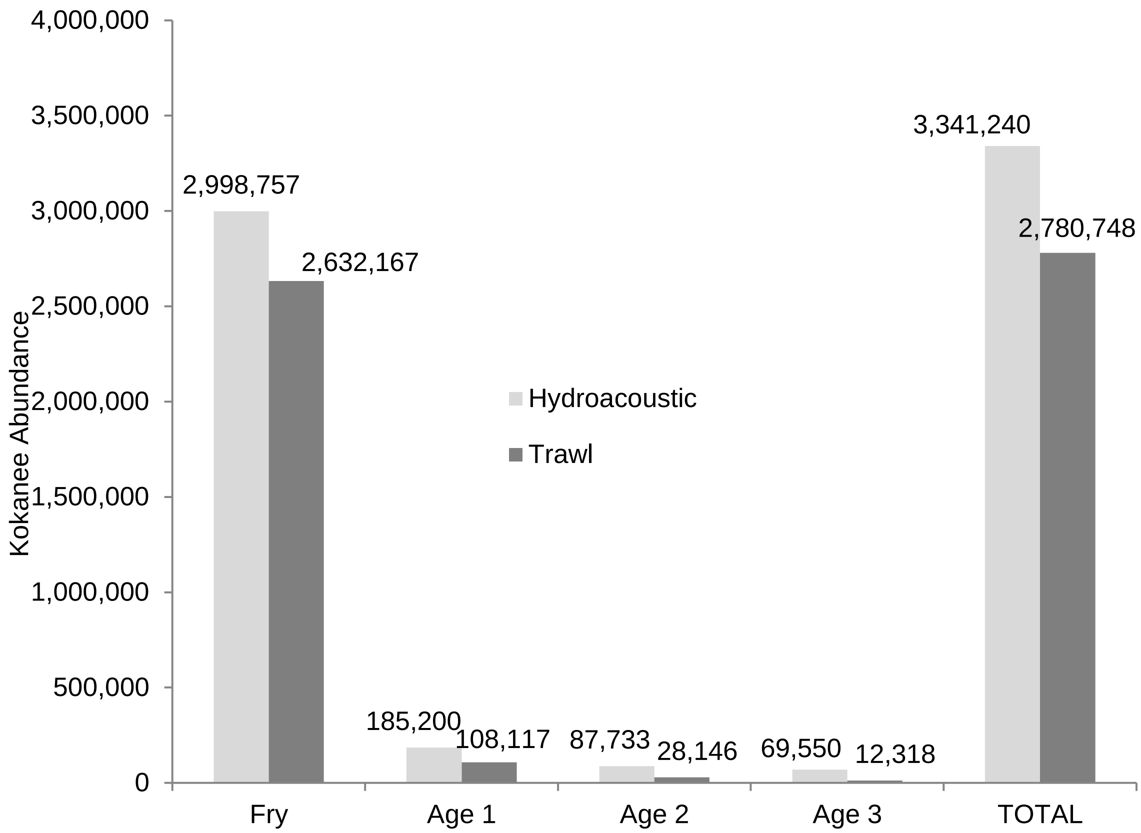


Figure 8. Comparison of hydroacoustic and trawl survey estimates of kokanee in Anderson Ranch Reservoir in 2011.

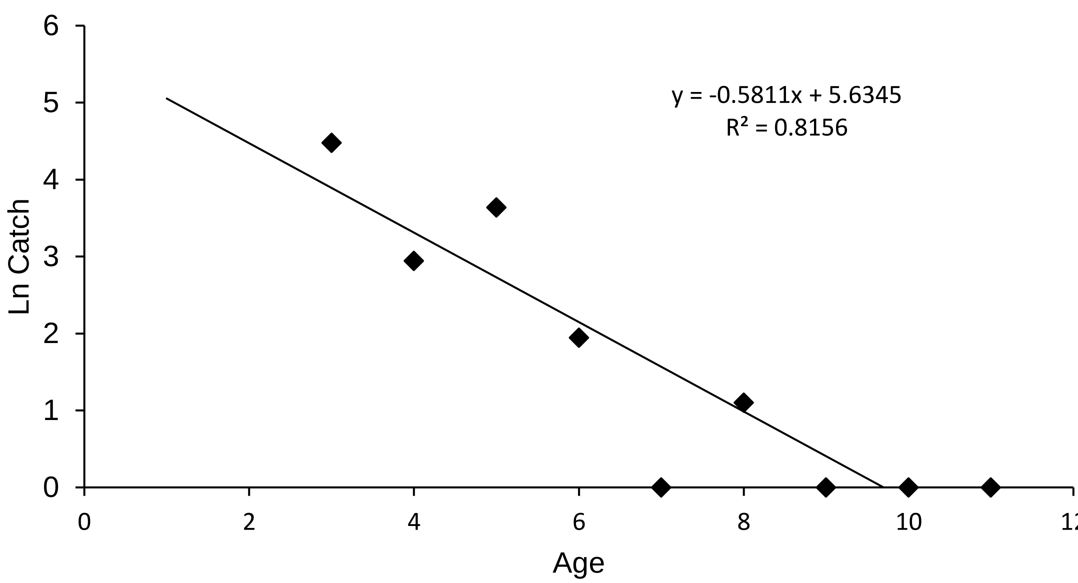
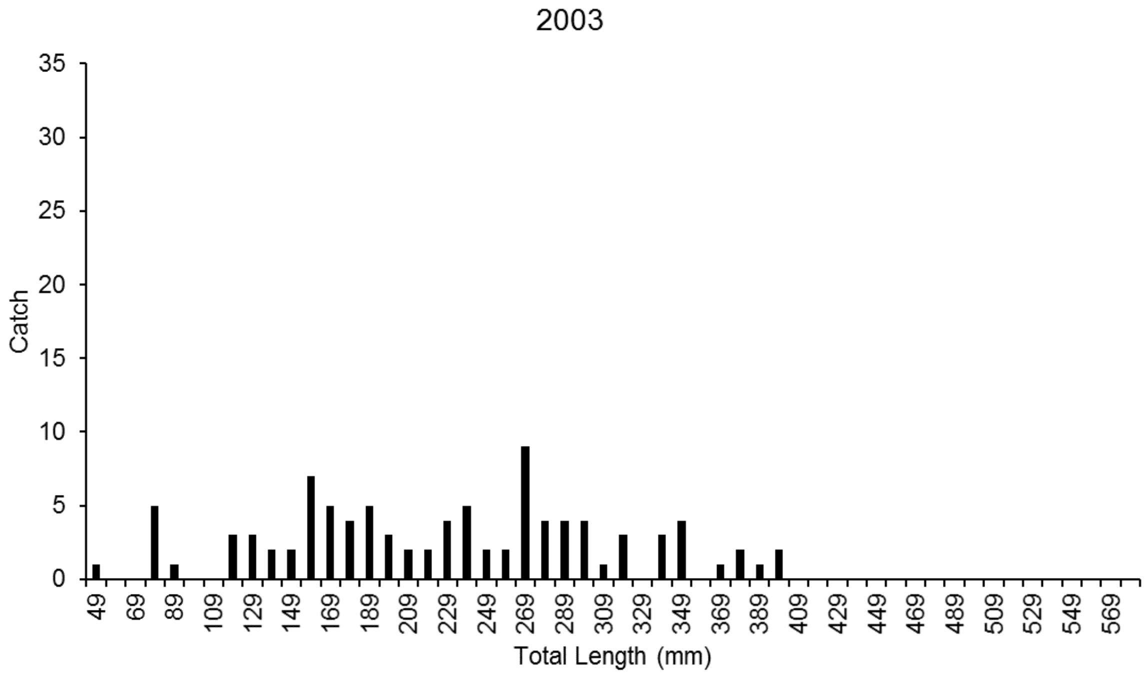


Figure 9. Catch curve (Age 3-11 fish) for Smallmouth Bass (*n* = 157) sampled from ARR during 2011 with electrofishing.



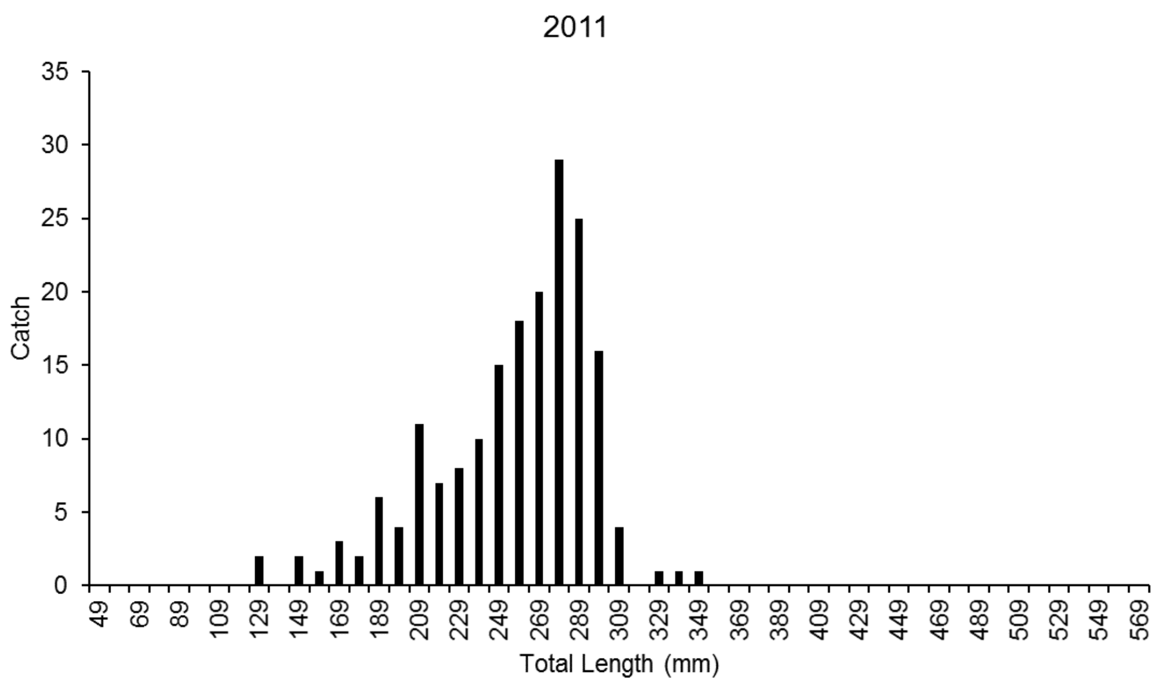


Figure 10. Length-frequency histogram for Largemouth Bass sampled from Dierkes Lake in 2003 (n = 96) and 2011(n = 186) with electrofishing.

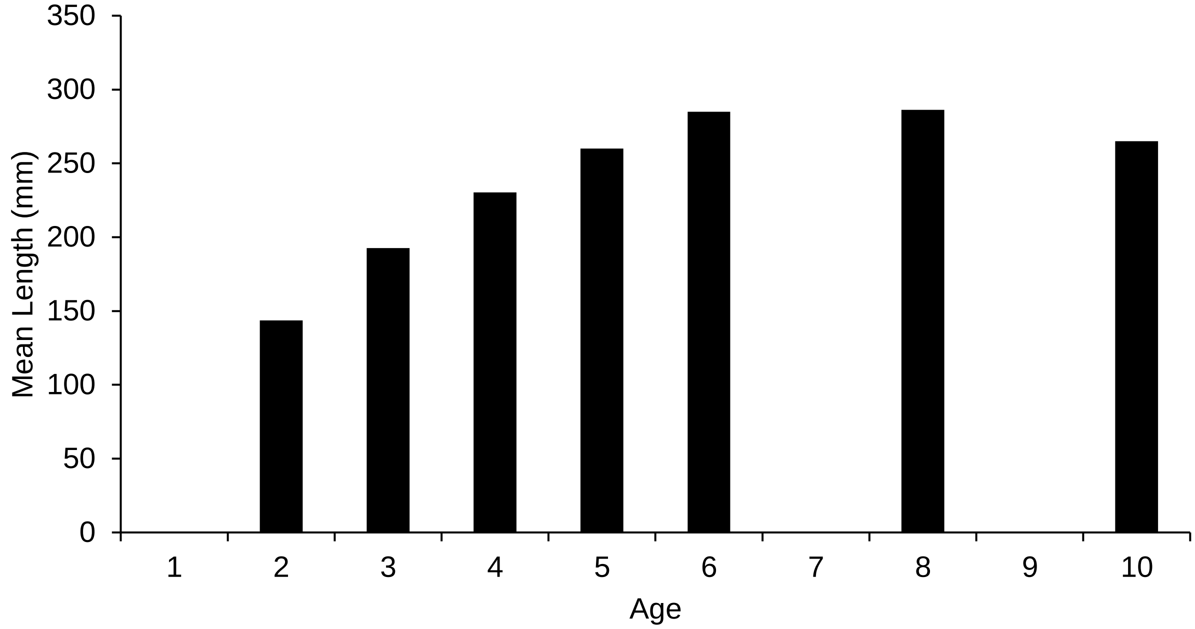


Figure 11. Mean length-at age of Largemouth Bass (n = 78) sampled from Dierkes Lake during 2011 with electrofishing.

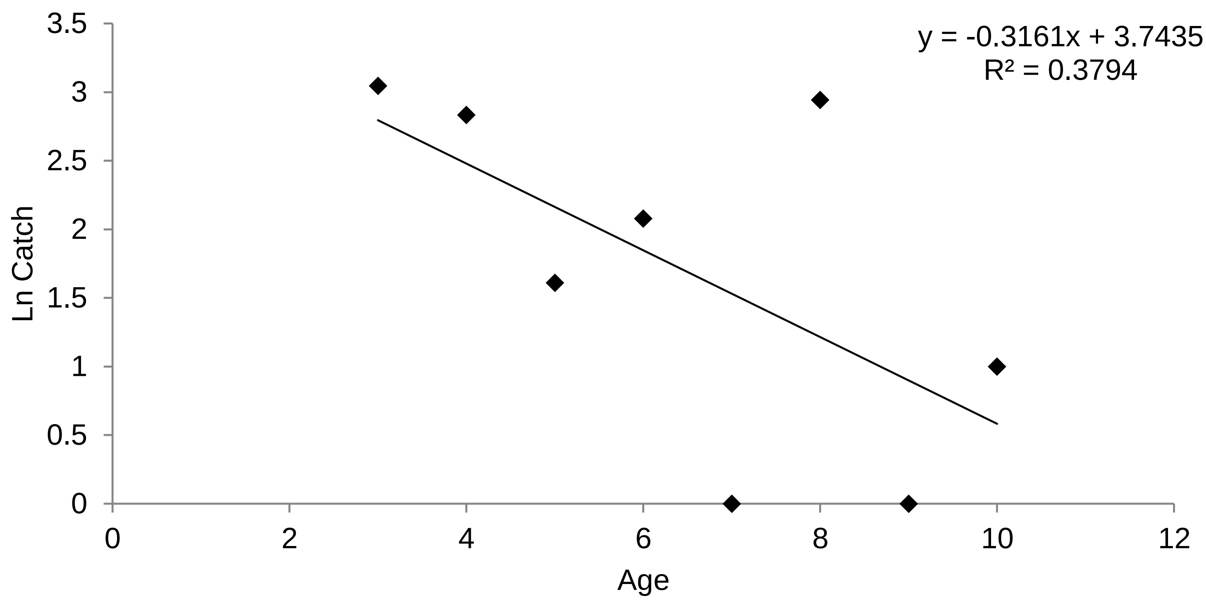


Figure 12. Catch curve for Largemouth Bass (n = 71) sample from Dierkes Lake during 2011 with electrofishing.

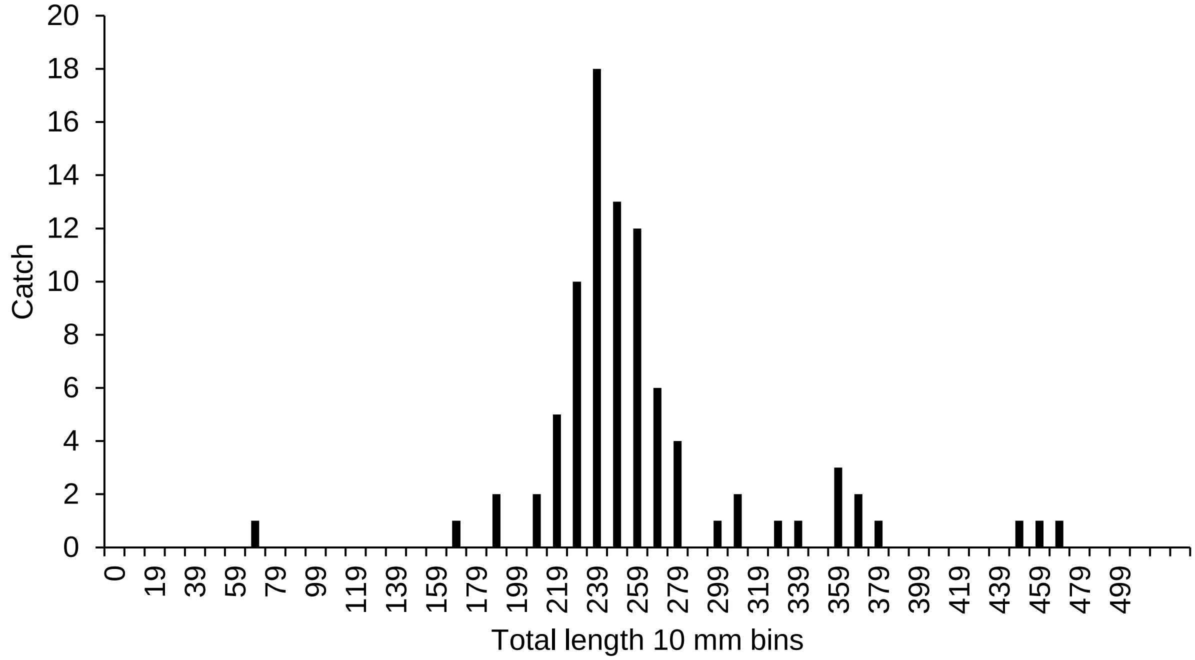


Figure 13. Length-frequency histogram for Channel Catfish (n = 88) sampled from Dog Creek Reservoir during 2011 with trap nets and angling.

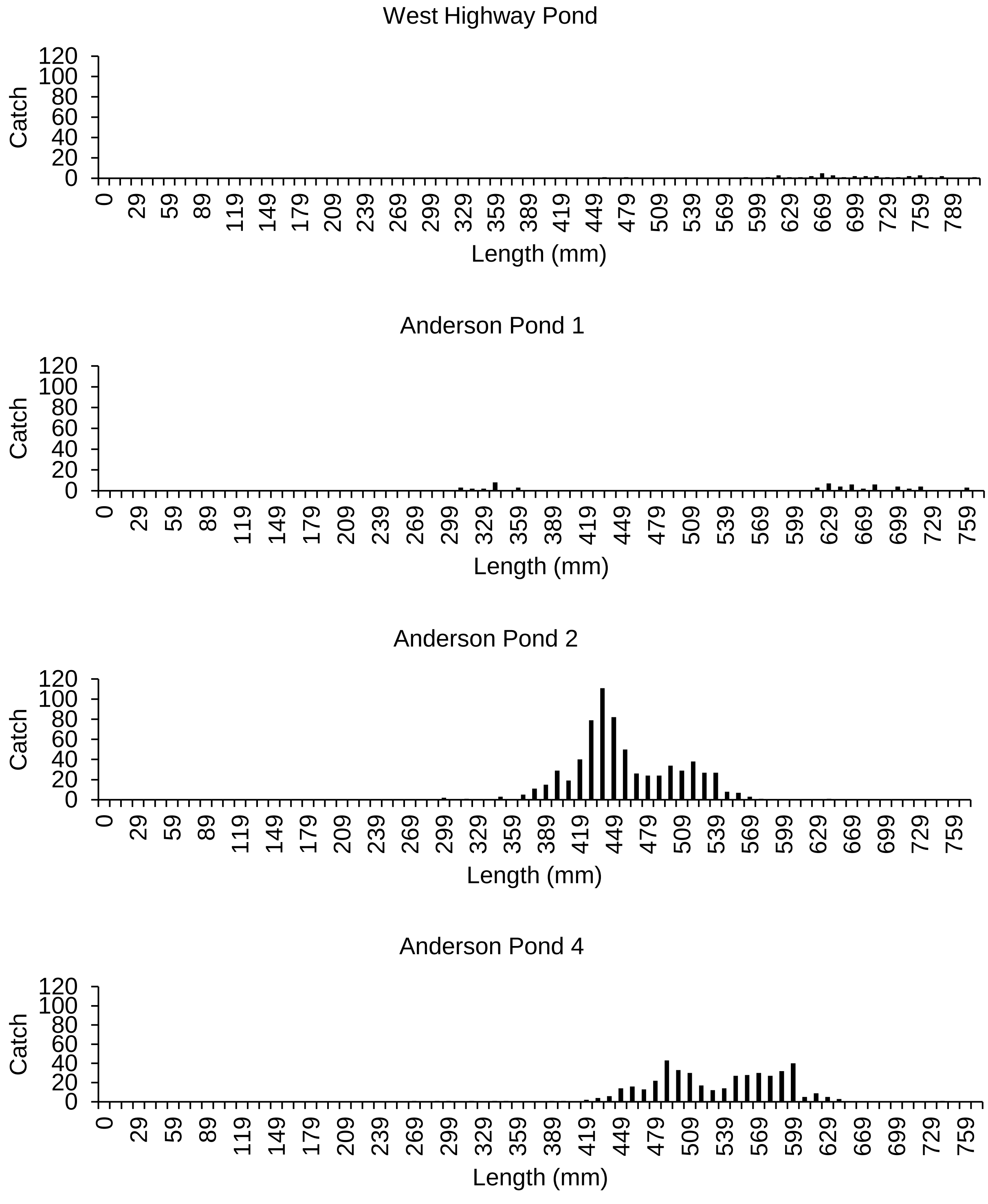


Figure 14. Comparative length-frequency for Common Carp collected from Hagerman WMA's West Highway Pond (n = 164), Anderson Pond 1 (n = 59), Anderson Pond 2 (n = 433), and Anderson Pond 4 (n = 181) in 2011 with electrofishing.

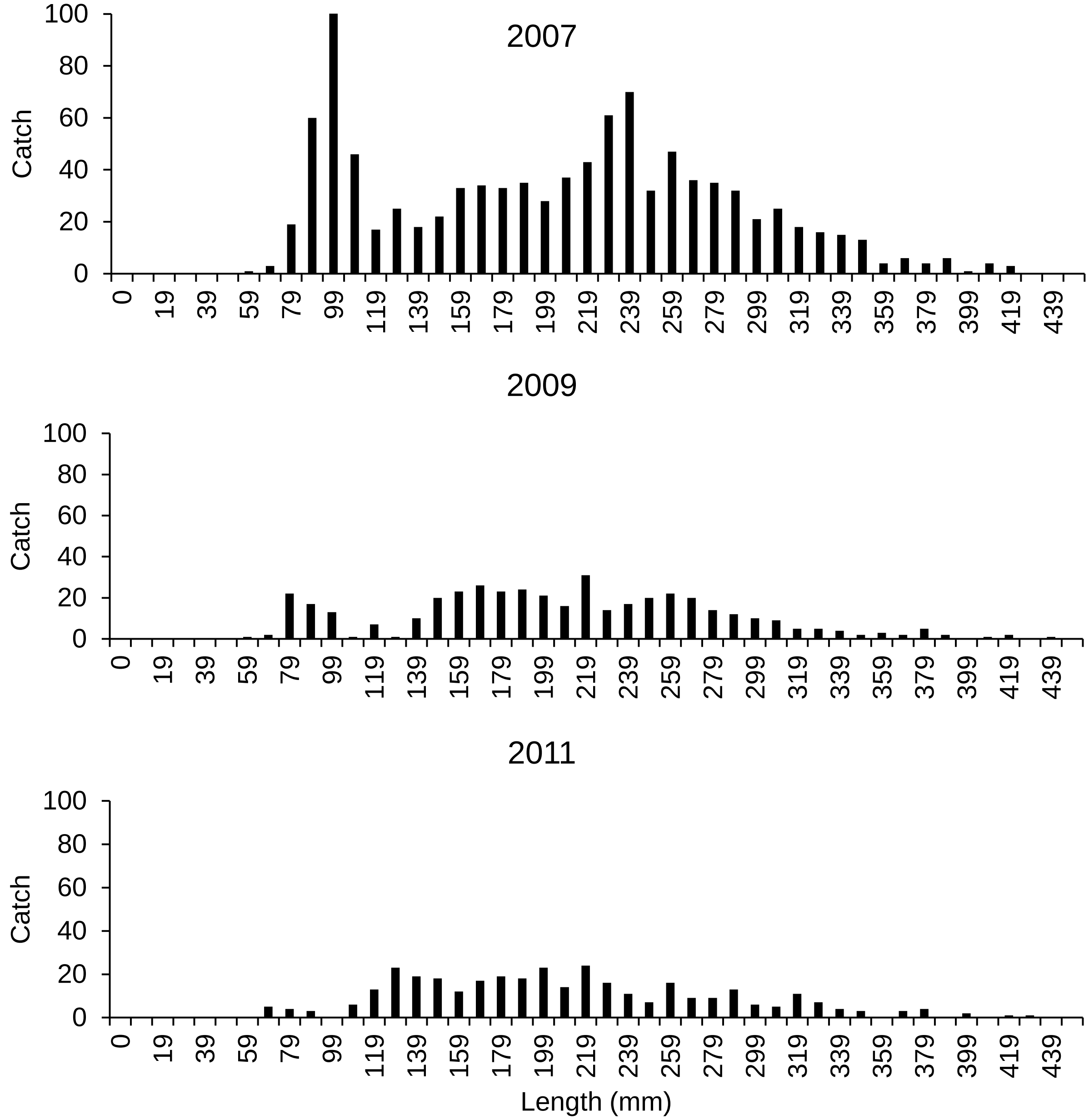


Figure 15. Length-frequency histograms for Smallmouth Bass collected at Milner Reservoir in 2007, 2009, and 2011, via electrofishing.

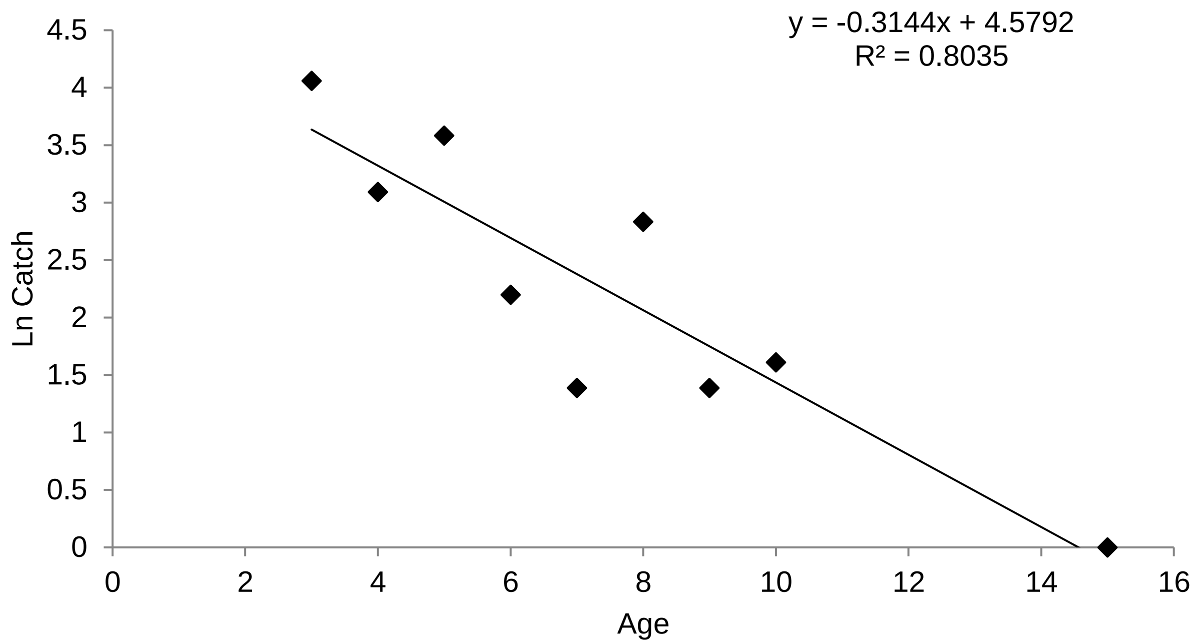


Figure 16. Catch curve for Smallmouth Bass (*n* = 158) sampled from Milner Reservoir in 2011 with electrofishing

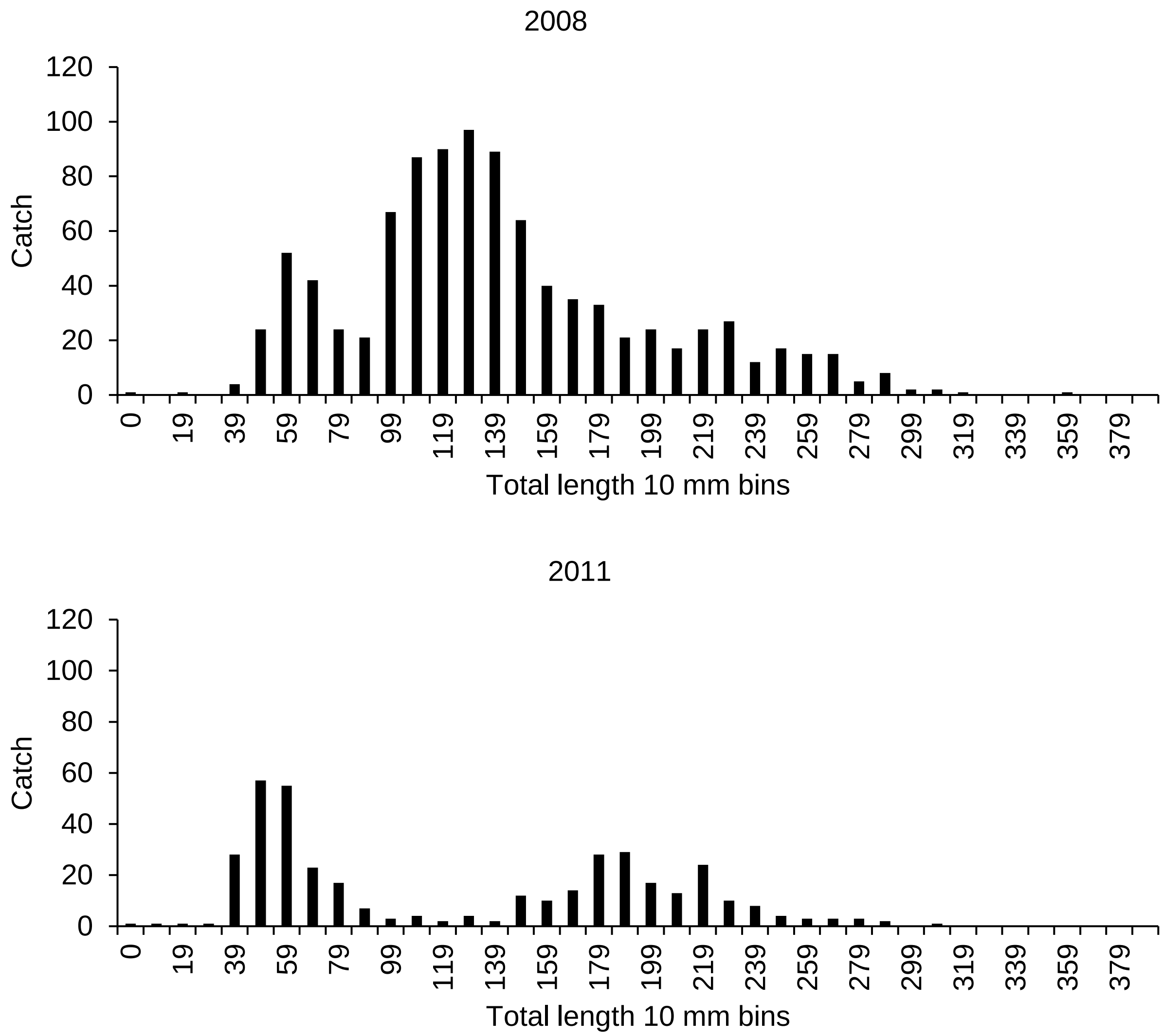


Figure 17. Comparative length-frequency histograms for Smallmouth Bass collected on Salmon Falls Creek Reservoir in 2008 (*n* = 962) and 2011 (*n* = 387), via electrofishing.

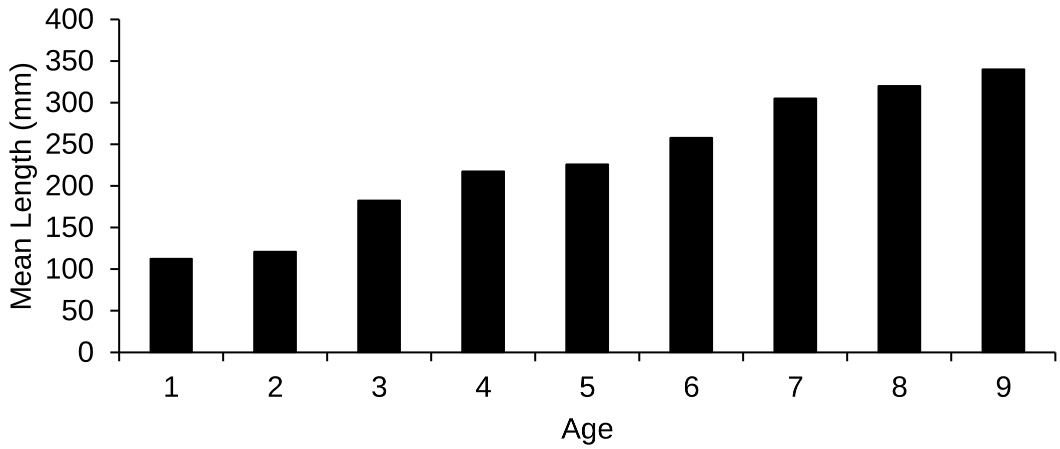


Figure 18. Mean length-at-age for Smallmouth Bass (n = 116) sampled from Salmon Falls Creek Reservoir during 2011 with electrofishing.

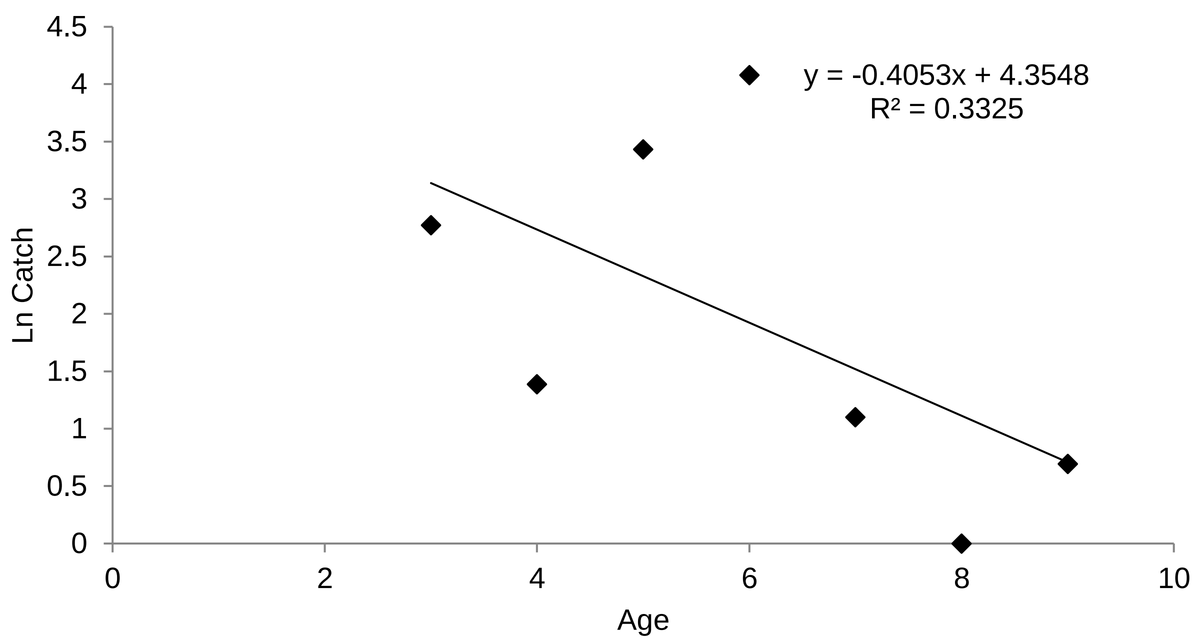


Figure 19. Catch curve for Smallmouth Bass (n = 116) sampled from Salmon Falls Creek Reservoir during 2011 with electrofishing.

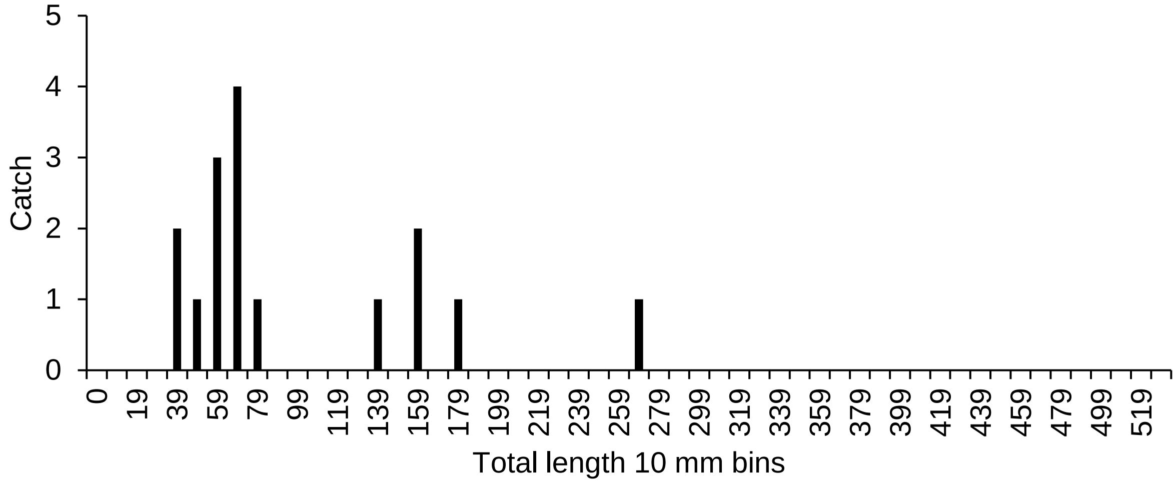


Figure 20. Length-frequency histogram for Yellowstone Cutthroat Trout (n = 60) sampled in Sixmile Creek during 2011 with electrofishing.

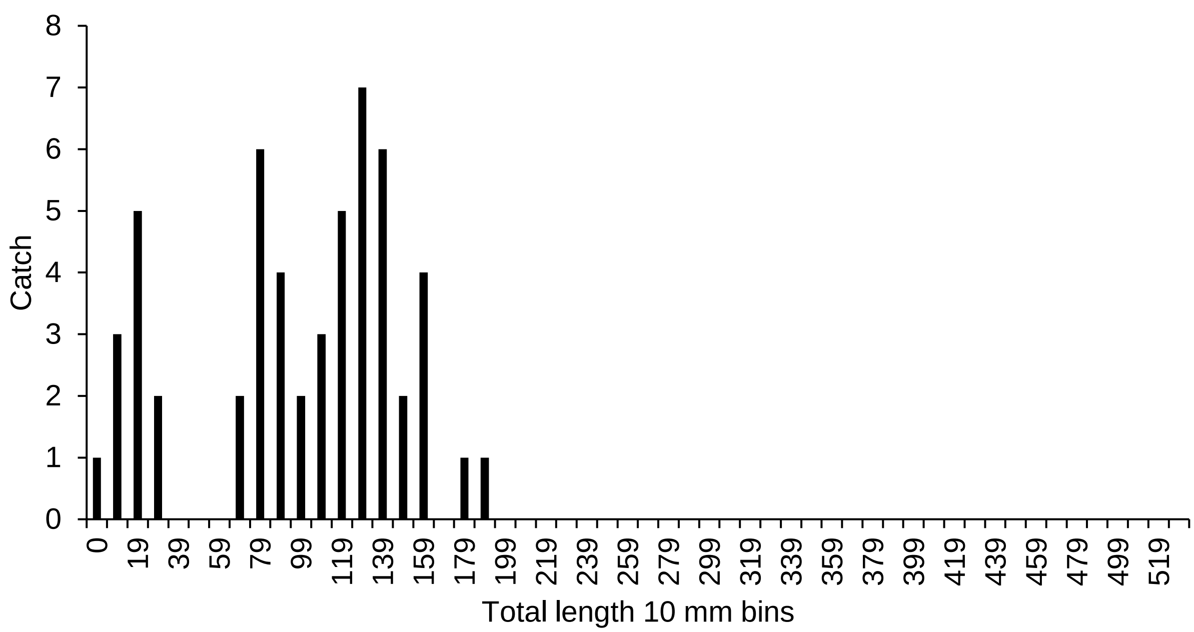


Figure 21. Length-frequency histogram for Yellowstone Cutthroat Trout (n = 54) translocated from Eightmile Creek into Gunnel Reservoir during 2011.

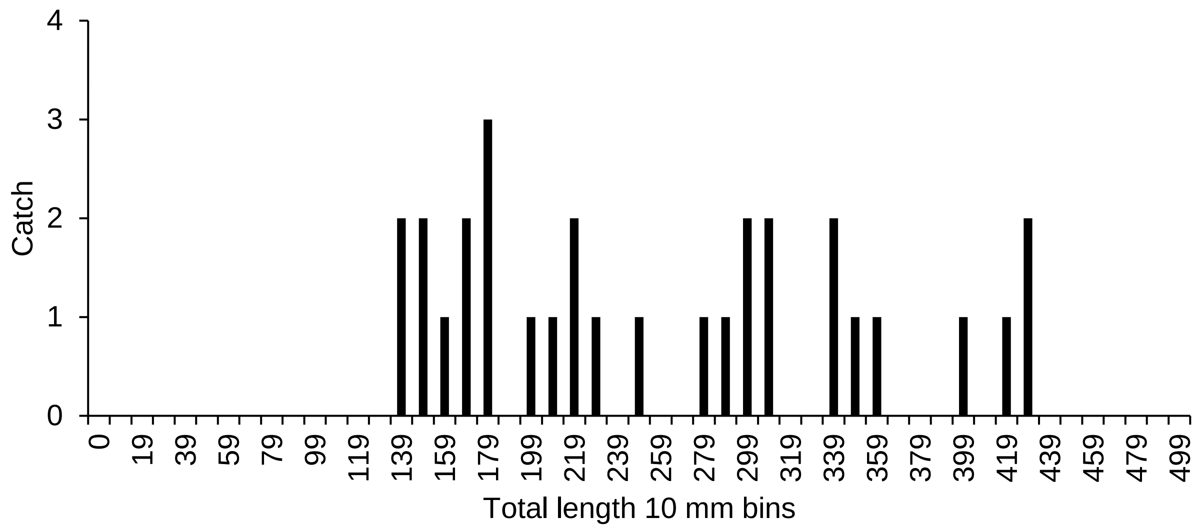


Figure 22. Length-frequency histogram for Bull Trout (n = 30) sampled from the South Fork Boise River during 2011, with electrofishing.

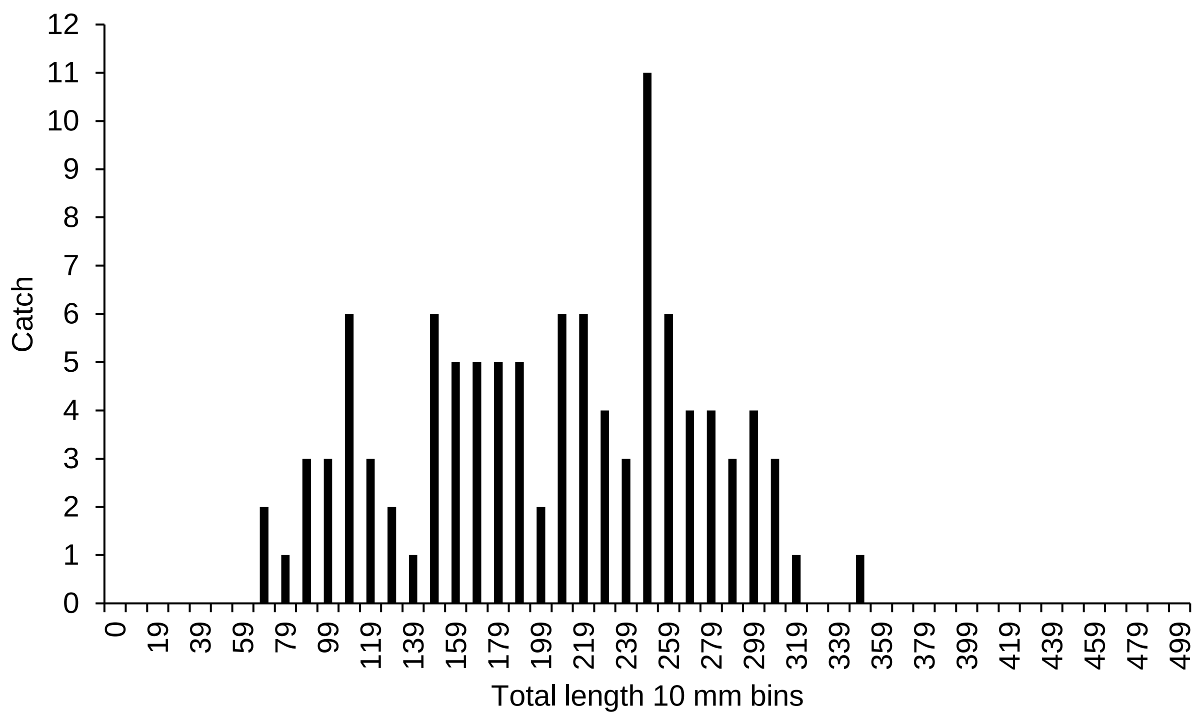


Figure 23. Length-frequency histogram for Rainbow Trout (n = 105) sampled in the South Fork Boise River during 2011 with electrofishing.

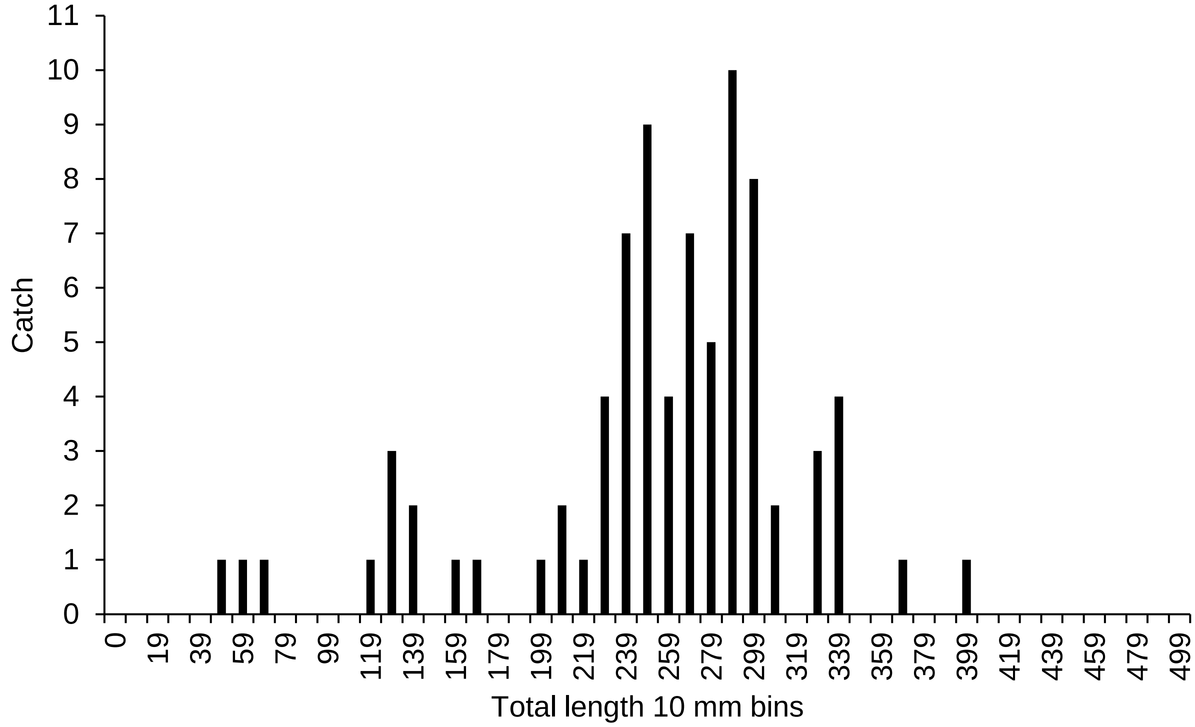


Figure 24. Length-frequency histogram for Mountain Whitefish (n = 80) sampled from the South Fork Boise River during 2011 with electrofishing.

TABLES

Table 1. Kokanee age and length (mm TL) from a midwater trawl survey (July 27-28, 2012), and equivalent target strength (-dB) from a hydroacoustic survey (August 1-2, 2012), in Anderson Ranch Reservoir.

Kokanee Size Range		
Age	Total Length (mm)	Acoustic Target Strength (-dB)
Fry	16 – 123	60.0 - 43.0
Age 1	124 – 224	42.9 - 38.0
Age 2	205 – 363	39.0 - 34.0
Age 3	305 – 462	36.0 - 32.0

Table 2. Hydroacoustic survey transect data including number of pings analyzed, nautical area scattering coefficient (NASC), mean target strength (dB), and density estimates (no./ha) of kokanee in each transect on Anderson Ranch Reservoir, August 1-2, 2011.

Reservoir Section	Transect Number	Number of Pings Analyzed	NASC	Mean Target Strength (-dB)	Kokanee Density (number/ha)				
					Fry	Age 1	Age 2	Age 3	TOTAL
Lower (1)	1	2,402	185.48	48.7	,123	71	26	6	3,226
	2	2,810	252.38	49.4	,989	78	29	3	5,098
	3	2,732	185.64	49.8	,054	26	11	2	4,093
	4	2,430	121.82	49.8	,662	20	6	1	2,689
	5	2,607	126.53	49.8	,761	32	6	1	2,800
	6	2,927	128.29	49.1	,335	55	16	0	2,406
	7	2,227	105.21	48.1	,509	59	27	1	1,596
Mid (2)	8	2,379	128.05	47.5	,543	87	27	3	1,661
	9	2,384	142.81	47.3	,660	102	29	5	1,796
	10	2,781	212.07	46.1	,793	145	45	8	1,990
	11	2,540	181.33	43.3	701	138	41	19	898
	12	2,451	255.84	41.1	491	157	74	37	759
	13	3,357	325.87	40.3	572	120	75	41	808
Upper (3)	14	2,685	518.98	39.3	630	211	96	91	1,029
	15	1,754	1036.23	38.0	845	306	173	183	1,507
	16	1,860	758.77	37.7	561	199	140	145	1,045
	17	2,072	385.30	37.9	333	89	57	75	554
	18	1,685	516.20	37.3	312	117	113	101	643
	19	930	110.53	34.2	28	8	5	27	68

Table 3. Hydroacoustics-based density and abundance estimates for kokanee in ARR. The survey was completed on August 3, 2011.

Section (area)	Kokanee Age	Density (fish/ha)		Abundance	
		Estimate	90% CI (±/-)	Estimate	90% CI (±/-)
Lower (680 ha)	Fry	3,062	-	2,081,994	-
	Age 1	49	-	33,135	-
	Age 2	17	-	11,684	-
	Age 3	2	-	1,322	-
	Total	3,130	-	2,128,135	-
Mid (590 ha)	Fry	1,127	-	664,704	-
	Age 1	125	-	73,574	-
	Age 2	48	-	28,613	-
	Age 3	19	-	11,225	-
	Total	1,319	-	778,115	-
Upper (394 ha)	Fry	452	-	177,971	-
	Age 1	155	-	60,993	-
	Age 2	98	-	38,416	-
	Age 3	104	-	40,782	-
	Total	808	-	318,162	-
TOTAL (1,664 ha)	Fry	1,758	318	2,924,668	528,793
	Age 1	101	24	167,703	40,299
	Age 2	47	14	78,713	23,446
	Age 3	32	12	53,329	20,656
	TOTAL	1,938	327	3,224,413	544,846

Table 4. Whole lake population estimates for Anderson Ranch Reservoir kokanee, based on trawling in 2011.

Strata	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Total
			Abundance (#)				
1	45,100	24,977	16,321	9,398	0	0	95,796
2	565,142	60,183	9,898	2,920	0	0	638,143
3	2,021,925	22,957	1,927	0	0	0	2,046,809
Total	2,632,168	108,117	28,146	12,319	0	0	2,780,750
			Density (#/ha)				
1	27	15	10	6	-	-	58
2	340	36	6	2	-	-	383
3	1,215	14	1	-	-	-	1,230
Total	1,582	65	17	7	-	-	1,671
			Biomass Estimates (kg)				
1	129	2,190	5,276	3,327	-	-	10,923
2	1,632	4,824	2,367	1,059	-	-	9,882
3	5,764	1,175	296	-	-	-	7,235
Total	7,525	8,189	7,939	4,386	-	-	28,040
			Standing Crop Estimates (kg/ha)				
1	0	3	8	5	0	0	16
2	3	8	4	2	0	0	17
3	15	3	1	0	0	0	18
Total	5	5	5	3	0	0	17

Table 5. Anderson Ranch Reservoir kokanee abundance estimates for 2003-2011.

Year	Age 0	Age 1	Age 2	Age 3	Age 4
2003	166,214	9,062	3,790	1,091	0
2004					
2005	526,307	37,980	12,736	20,652	0
2006	1,186,580	192,890	40,528	9,827	0
2007	692,704	841,421	97,832	66,645	0
2008	1,172,086	40,712	152,748	30,584	0
2009	431,627	57,410	15,021	10,134	0
2010	786,879	45,215	137,352	44,507	3,335
2011	2,632,168	108,117	28,146	12,319	0

Table 6. Creel survey structure and estimated angling effort expended at Hagerman WMA ponds during 2011.

	Weekdays	Weekends	All days
Creel days (*n*)	8	11	52
All days (*n*)	88	32	120
Ave. counts / day	1	1	1
Estimated effort (E)	1,535	3,126	4,661
95% Lower Confidence Limit	1,379	2,970	4,505
95% Upper Confidence Limit	1,691	3,282	4,817

Table 7. Catch and harvest of fish at Hagerman WMA ponds during 2011, including 95% confidence limits (CL).

	Catch			Harvest	
Species	Number	CL	Rate (#/h)	Number	CL
All species combined	4,707	4,549 - 4,865	1.01	2,494	2,336 - 2,652

Table 8. Standard bass sampling indices among Magic Valley Region fisheries 2005-2011. CPUE is reported as fish per hour.

Fishery	Species	Measure	2005	2006	2007	2008	2009	2010	2011
Anderson Ranch	SMB	Ave. catch (CPUE)			355	82			137
		Ave. length (mm)			114	198			167
		Ave length @ Age 5			251	280			237
		PSD			17	36			22
		RSD(S-Q)			83	64			78
		Max. age (years)			5	6			11
Bell Rapids Res.	LMB/SMB	Ave. catch (CPUE)	49			26	38		
		Ave. length (mm)	287			244	277		
		Ave length @ Age 5	286			302	325		
		PSD	59			33	56		
		RSD(S-Q)	13			67	44		
		Max. age (years)	11			10	10		
Milner Res.	SMB	Ave. catch (CPUE)			252		74		92
		Ave. length (mm)			198		200		202
		Ave length @Age 5			315		264		273
		PSD			28		26		39
		RSD(S-Q)			72		74		61
		Max. age (years)			9		11		15
Salmon Falls Cr.	SMB	Ave. catch (CPUE)				241			129
		Ave. length (mm)				185			168
		Ave length @Age 5				220			226
		PSD				33			21
		RSD(S-Q)				67			79
		Max. age (years)				7			9
Lake Walcott	SMB	Ave. catch (CPUE)	111	204			125		
		Ave. length (mm)	166	132			160		
		Ave length @Age 5	420	418			387		
		PSD	15	17			45		
		RSD(S-Q)	85	83			55		
		Max. age (years)	13	13			13		
Dierkes Lake	LMB	Ave. catch (CPUE)							124
		Ave. length (mm)							249
		Ave length @Age 5							260
		PSD							12
		RSD(S-Q)							88
		Max. age (years)							10

Table 9. Trends in abundance of Rainbow Trout and Mountain Whitefish in the South Fork Boise River from 1991 to 2011.

Species	Year	Abundance (> 100 mm)	± 95% CI
Mountain whitefish	2011	230	144
	2008	411	97
	2005	336	63
	2002	399	147
	1998	683	272
	1994	377	107
	1991	735	231
Rainbow Trout	2011	405	260
	2008	654	135
	2005	602	184
	2002	484	134
	1998	858	352
	1994	576	146
	1991	534	252

Table 10. Abundance and density estimates for fish collected on the South Fork Boise River during 2011.

Species	Length group (mm)	M	C	R	Abundance	95% CI	Linear Density[a]	Areal Density[b]
Wild Rainbow Trout	100-499	57	48	6	405	260	36.7	1.98
Mountain Whitefish	100-499	44	35	6	230	144	18.8	0.86

[a] Fish / 100 m

[b] Fish / 100 m^2

APPENDICES

APPENDIX A. SURVEY LOCATIONS

Water	Site	Gear	E	N	Z	Datum
ANDERSON RANCH	1	E-FISHING	626546	480154	11	WGS84
ANDERSON RANCH	2	E-FISHING		4802592	11	WGS84
ANDERSON RANCH	3	E-FISHING	627817	4803796	11	WGS84
ANDERSON RANCH	4	E-FISHING	627832	4803802	11	WGS84
ANDERSON RANCH	5	E-FISHING	630399	4805854	11	WGS84
ANDERSON RANCH	6	E-FISHING	630465	4806522	11	WGS84
ANDERSON RANCH	7	E-FISHING	634318	4806157	11	WGS84
ANDERSON RANCH	8	E-FISHING	635715	4807854	11	WGS84
ANDERSON RANCH	9	E-FISHING	636953	4808610	11	WGS84
ANDERSON RANCH	10	E-FISHING	637294	4808395	11	WGS84
ANDERSON RANCH	11	E-FISHING	638728	4808914	11	WGS84
ANDERSON RANCH	12	E-FISHING	637966	4808609	11	WGS84
ANDERSON RANCH	13	E-FISHING	637262	4811172	11	WGS84
ANDERSON RANCH	14	E-FISHING	638311	4811434	11	WGS84
ANDERSON RANCH	15	E-FISHING	638351	4811361	11	WGS84
ANDERSON RANCH	16	E-FISHING	638591	4810911	11	WGS84
BILLINGSLEY CREEK	1	Floy Tagging	672417	4744589	11	WGS84
DIERKES LAKE	1	E-FISHING	714676	4719288	12	WGS84
DIERKES LAKE	2	E-FISHING	714695	4719274	12	WGS84
DIERKES LAKE	3	E-FISHING	714403	4719283	12	WGS84
DIERKES LAKE	4	E-FISHING	714523	4714328	12	WGS84
DIERKES LAKE	5	E-FISHING	714088	4719198	11	WGS84
DIERKES LAKE	6	E-FISHING	714461	4719203	11	WGS84
DOG CREEK RESERVOIR	1	TRAP NETS	711722	4797911	11	WGS84
DOG CREEK RESERVOIR	3	TRAP NETS	713475	4794421	11	WGS84
DOG CREEK RESERVOIR	4	TRAP NETS	711722	4797911	11	WGS84
DOG CREEK RESERVOIR	5	TRAP NETS	710653	4799945	11	WGS84
DOG CREEK RESERVOIR	6	TRAP NETS	713520	4796552	11	WGS84
DOG CREEK RESERVOIR	7	TRAP NETS	710766	4800431	11	WGS84
DOG CREEK RESERVOIR	8	TRAP NETS	711638	4796145	11	WGS84
DOG CREEK RESERVOIR	9	TRAP NETS	711638	4796145	11	WGS84
DOG CREEK RESERVOIR	10	TRAP NETS	711638	4796145	11	WGS84
DOG CREEK RESERVOIR	11	TRAP NETS	711638	4796145	11	WGS84
DOG CREEK RESERVOIR	12	TRAP NETS	711638	4796145	11	WGS84
HAGERMAN WMA	1	E-FISHING	673561	4736848	11	WGS84
HAGERMAN WMA	2	E-FISHING	673579	4736810	11	WGS84
HAGERMAN WMA	3	E-FISHING	673618	4736816	11	WGS84
HAGERMAN WMA	4	E-FISHING	673604	4736918	11	WGS84
MILNER RESERVOIR	1	E-FISHING	275830	4711127	12	
MILNER RESERVOIR	2	E-FISHING	275842	4711094	12	
MILNER RESERVOIR	3	E-FISHING	277752	4710802	12	
MILNER RESERVOIR	4	E-FISHING	274132	4712336	12	

Appendix A (continued)

Water	Site	Gear	E	N	Z	Datum
MILNER RESERVOIR	5	E-FISHING	273683	4712644	12	
MILNER RESERVOIR	6	E-FISHING	273206	4714145	12	
MILNER RESERVOIR	7	E-FISHING	273203	4714157	12	
MILNER RESERVOIR	8	E-FISHING	270466	4714911	12	
MILNER RESERVOIR	9	E-FISHING	262368	4714489	12	
MILNER RESERVOIR	10	E-FISHING	261367	4714359	12	
MILNER RESERVOIR	11	E-FISHING	259704	4713290	12	
MILNER RESERVOIR	12	E-FISHING	258299	4713135	12	
MILNER RESERVOIR	13	E-FISHING	258246	4713030	12	
MILNER RESERVOIR	14	E-FISHING	257308	4713126	12	
MILNER RESERVOIR	15	E-FISHING	254793	4713478	12	
SOUTH FORK BOISE RIVER	1	E-FISHING	686828	4667376	11	
SALMON FALLS CREEK RES.	1	E-FISHING	687127	4674818	11	WGS84
SALMON FALLS CREEK RES.	2	E-FISHING	685924	4672771	11	WGS84
SALMON FALLS CREEK RES.	3	E-FISHING	687050	4669902	11	WGS84
SALMON FALLS CREEK RES.	4	E-FISHING	685924	4672771	11	WGS84
SALMON FALLS CREEK RES.	5	E-FISHING	686620	4665460	11	WGS84
SALMON FALLS CREEK RES.	6	E-FISHING	686087	4671219	11	WGS84
SALMON FALLS CREEK RES.	7	E-FISHING	687466	4667937	11	WGS84
SALMON FALLS CREEK RES.	8	E-FISHING	686828	4667376	11	WGS84
SALMON FALLS CREEK RES.	9	E-FISHING	686465	4664366	11	WGS84
SALMON FALLS CREEK RES.	10	E-FISHING	685831	4662895	11	WGS84
SALMON FALLS CREEK RES.	11	E-FISHING	685809	4663606	11	WGS84
SALMON FALLS CREEK RES.	12	E-FISHING	686133	4665452	11	WGS84
SIXMILE CREEK/GUNNEL RES	1	E-FISHING	730007	4799575	11	WGS84

APPENDIX B. SPECIFICATIONS OF SAMPLING EQUIPMENT USED FOR FISHERY SURVEYS IN 2011

Fishery type	Equipment	Description
Mountain lakes	Mountain lake gill net	Swedish made Lundgrens type-A lightweight multi filament sinking net 6 panel (46, 38, 33, 30, 25, 19 mm bar-mesh) 45.6 X 1.5 m
	Scale	Pesola ©: , 0-300 g, 0-1 kg, 0-2.5 kg scales
	Float tube	Creek Company© , round
	Conductivity meter	Yellow Springs Instrument (YSI) model 30
	Depth sounder	Hondex© portable depth sounder
	Secci disc	Standard; decimeter graduation
	pH meter	Oakton © hand held pH meter - Model 35624.2
Lakes & res.	Power boat electrofisher	Smith-root © model SR-18 w/ model 5.0 pulsator
	Boom	Aluminum (2.6 m-long)
	Anode	Octopus-style steel danglers (1 m-long)
	Cathode	Boat and cathode array danglers - simultaneous
	Live well	Fresh flow aerated; 0.65 m^3
	Oxygen stone	35.6 X 3.8 cm (135 m^2); fine pore
	Generator	Honda © ; model EG5000x; 5,000 watt
	Electrofishing control box	Coffelt © ; model 15 VVP
	Sinking gillnet	6 panels (19, 25, 32, 38, 51, 64 mm bar-mesh); 38 x 1.8 m; monofilament
	Floating gillnet	6 panels (19, 25, 32, 38, 51, 64 mm bar-mesh); 38 x 1.8 m; monofilament
	Walleye Gillnet (FWIN)	8 panel (25, 38, 51, 64, 76, 102, 127, 152 mm bar-mesh); 61 x 1.8 m, monofilament
	Trap net	1.8 x 0.9 m box, 5 - 76 cm hoops, 15.2 m lead, 2 cm bar mesh
	Seine	18 m x 1 m, 6 mm mesh 18 m x 1 m, 3 mm mesh
	Conductivity meter	Yellow Springs Instruments © (YSI); model 30
	Plankton nets	250, 500, 750 *u* mesh; 0.5 m diameter mouth; 2.5 m depth
	Temperature / D.O. meter	Yellow Springs Instruments © (YSI); model 550A
	Dip nets	2.4 m-long handles ; trapezoid heads (0.6 m^2); 9.5 mm bar-mesh
	Secci disc	Standard; decimeter graduation
	Field PDA	Juniper Systems ©, model Allegro handheld; waterproof, WinCE/DOS compatible
	Scales	AND© 5000g electronic, OHAUS© 3000g, electronic Pesola ©: , 300 g, 1 kg, 2.5 kg, 5.0 kg scales

Fishery type	Equipment	Description
Rivers and streams	Power boat electrofisher	Smith-root © model SR-18 w/ model 5.0 pulsator - see above for specs.
	Outcast Power Drifter Raft	3.35 m
	Anode	13.7 m-long power cord; 2.4 m-long fiberglass handle; 0.4 m diameter steel hoop
	Cathode	Boat
	Live well	208 L plastic garbage can; O_2 supplemented
	Drift boat	4.5 m-long aluminum
	Boom	4.3 m-long fiberglass
	Anode	Octopus-style steel danglers (1 m-long)
	Cathode	Boat
	Live well	208 L rubber stock watering tub; O_2 supplemented
	Scales	AND© 5000g,electronic, OHAUS© 3000g,electronic Pesola © : , 300 g, 1 kg, 2.5 kg, 5.0 kg scales
	Oxygen stone	35.6 X 3.8 cm (135 m^2); fine pore
	Generator	Honda © ; model EG5000x; 5,000 watt
	Electrofishing control box	Coffelt © Model 15 VVP
	Oxygen stone	35.6 X 3.8 cm (135 m^2); fine pore
	Dip nets	2.4 m-long handles ; trapezoid heads (0.6 m^2); 9.5 mm bar-mesh
	Backpack electrofisher	Smith-root © model 15-D; single anode
	Conductivity meter	Yellow Springs Instrument © (YSI) model 30

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